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ABSTRACT

Under contract with the Ontario Ministry of Education, the Faculty of Education of the University of Ottawa undertook a comprehensive study of the needs and characteristics of students in the intermediate years, ages 12 to 16. The approach consisted in developing a relevant and pertinent synthesis of information, based on quality research studies, concerning the physical, intellectual, social, and emotional characteristics of adolescents in the 12 to 16 age group. It is hoped that such a synthesis as provided in this document will bring greater awareness on the part of teachers of the necessity for implementing educational processes compatible with the needs and characteristics of early adolescence and that, in addition, it will serve advantageously as a valid and reliable basis for decision making relative to educational programs intended for the intermediate division. (Author)

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NEEDS AND CHARACTERISTICS OF STUDENTS IN THE INTERMEDIATE YEARS, AGES 12-16

A Comprehensive Review of the Literature 1930-1974
With Recommendations for Educational Practice

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TABLE OF CONTENTS

Chapter page

INTRODUCTION... ix

I.- OVERVIEW OF ADOLESCENT GROWTH AND DEVELOPMENT.............. 1
  1. The Meaning of Adolescence 1
  2. Theories and Other Important Points of View 4
    i. The Nature and Value of Theories 4
    ii. Biological Theories 5
    iii. Cultural and Sociological Theories 7
    iv. Psychoanalytic Theory 7
    v. Psychological Theories 8
    vi. Psychobiological-Psychosocial Theory of Adolescence 11
  3. Goals of Adolescence 14
  4. Psychological Consequences of Biological Change 17
    i. Physical Growth 17
    ii. Misconceptions about Adolescent Growth 21
  5. Psychological Affect of Physiological Changes 22
    i. Self-Concept and Physical Change 23
    ii. Development of Sexual Behaviour 28
  6. Psychological Affect of Changes in Cognitive Functioning 32
    i. Research Orientations 33
    ii. Trends in Research on Adolescent Cognitive Functioning 35
    iii. Implications of Piagetian Theory 40
  7. The Need for Curriculum Reform Based on Knowledge of Adolescence 43

II.- GROWTH AND OTHER PHYSIOLOGICAL LEVELS AND EVENTS IN ADOLESCENTS.. 46
  1. Introduction 46
  2. Growth in Adolescents 51
    i. Patterns of Growth in Height and Weight 51
    ii. Sexual Maturation in Adolescents 56
    iii. Physiological Age, Chronological Age, and Sexual Maturation 64
    iv. The Relationship Between Sexual Maturation and Other Physiological Parameters 68
    v. Hormones and Adolescents 73
    vi. Secular Trends in Growth and Development 85
    vii. Growth Standards 89
  3. Other Physiological Levels and Events in Adolescents 93
    I. Introduction 93
    ii. Digestion and Nutrition 93

TABLE OF CONTENTS

Chapter page

iii. Metabolism and Respiration 98
iv. Circulation 102
4. Child-Bearing in Adolescence 113
5. Biorhythmicity of Consciousness 118
6. Summary and Educational Implications 131
i. Summary 131
ii. Implication 134

III.- EARLY ADOLESCENT COGNITIVE FUNCTIONING AND INTELLECTUAL GROWTH.. 138
1. Introduction 138
2. Quantitative Aspects of Cognitive Development During Early Adolescence 144
i. Basic Structural Views of Intelligence 144
ii. Review of Methodology in Intelligence Testing 147
iii. Rates of Intellectual Growth During Adolescence 149
iv. IQ Constancy 153
v. Differentiation of Mental Abilities During Adolescence 156
vi. Representative Differences in Adolescent Intelligence 159
vii. Quantitative Aspects of Early Adolescent Cognitive Functioning; Implications for Educational Practice 162
3. Qualitative Aspects of Cognitive Functioning During Early Adolescence 164
i. Stages in Cognitive Development 165
ii. Formal Operational Thought During Early Adolescence 168
iii. Educational Implications of Qualitative Changes in Adolescent Cognitive Functioning 181
iv. Development of Thought and Language: Vygotsky's Theoretical Perspective 183
a. Applications to Education 191
b. Research Results 197
c. Summary and Discussion 203
4. Impact of Percepto-Cognitive Styles on Adolescent Cognitive Functioning 207
i. Developmental Trends in Perception 207
ii. Reflectivity-Impulsivity 216
iii. Field Dependence-Field Independence As a Cognitive Style 220

Chapter page

5. General Conclusions and Recommendations for Educational Practice 228

IV.- EMPIRICAL BASE FOR THE EMOTIONAL AND SOCIAL DEVELOPMENT OF NORMAL ADOLESCENTS.................................. 245
1. General Introduction 245
2. Emotional Development 252
    i. Emotional Maturity 252
    ii. Heightened Emotionality 257
    iii. Aggressive States 262
    iv. Inhibitory States - Fears 268
    v. Inhibitory States - Anxiety and Worry 273
    vi. Joyous and Happiness States or Affectivity 277
    vii. Self-Concept 283
3. Social Development 294
    i. Family 294
    ii. Peers 294
    iii. School 318
4. Summary for Emotional and Social Development 333

BIBLIOGRAPHY 340

LIST OF FIGURES

Figure page

1.- Physical Growth and Physiological Development in Adolescence.......... 19

2.- Diagram of the Circulatory Pattern in the Postnatal Human. Arrows Indicate Direction of Blood Flow.......... 105

3.- Histogram of Typical Sleep in Young Adults.......... 121

4.- Ninety Minutes Alternations of the Basic Rest-Activity Cycle (BRAC).......... 125

5.- Twenty-Four Hour Circadian Alterations Superimposed on the BRAC.......... 128

LIST OF TABLES

Table page

I.- Developmental Stages According to Erikson and Freud 9

II.- Sex Maturity Stages in Girls 59

III.- Sex Maturity Stages in Boys 60

IV.- Average Ages at Which Different Tanner Stages of Pubertal Development Are Reached by Boys and Girls 61

V.- Dimensions of Cognitive Style 210

Introduction

Under contract with the Ontario Ministry of Education, the Faculty of Education of the University of Ottawa undertook a comprehensive study of the needs and characteristics of students in the intermediate years, ages twelve to sixteen.

The approach adopted consisted in developing a relevant and pertinent synthesis of information, based upon quality research studies, concerning the physical, intellectual, social and emotional characteristics of adolescents in the twelve-to-sixteen age group.

It is hoped that such a synthesis as provided in this document will bring greater awareness on the part of teachers of the necessity for implementing educational processes compatible with the needs and characteristics of early adolescence and that, in addition, it will serve advantageously as a valid and reliable basis for decision making relative to educational programs intended for the intermediate division.

In this connection, the authors of the present document hope they have satisfactorily met the proposal discussed in the Position Paper re Cyclic Review: The Intermediate Years, New Dimensions, September 1972 particularly with respect to the following quotation lifted therefrom on page 3

> The need most often articulated by those concerned with the intermediate level is for a consistent and coherent approach to the education of the 12 to 16 year olds. This approach should recognize the unique nature and needs of this age group without being unduly influenced by the practices of the divisions preceding and following the intermediate.

The contents of the study were distributed over four separate chapters. The first chapter presents an overview of adolescent growth and development which serves the purposes of an introduction to the study as a whole. Chapter two deals with the physiological and biological factors of growth. It is our experience that unless teachers have a personal interest in physiology this section is generally passed over rather superficially. This is most unfortunate when one considers the numerous problems of growing up which are experienced by adolescents in a school setting and that are closely related to the quality and intensity of biological changes that constantly take place during these ages, 12 to 16.

Teachers of the intermediate grades who have grasped some of the major biological correlates of behaviour will not necessarily find solutions to all their educational problems but will certainly develop more intelligent approaches to the problem of education.

Curriculum designers should become as familiar with the research data presented in this Chapter two as they generally and hopefully are with the research conclusions relative to cognitive, emotional and social development. They must be constantly aware of the fact that in the biological sense at least, each individual adolescent child is at any one instant a wholly integrated human person; that is, that the individual adolescent is operating as an efficient biological machine within the limits of his/her evolutionary and environmental background, is accomplishing those biological events that it should be, and is, furthermore, accomplishing them in an integrated manner.

In Chapter three, the authors of this report have attempted to cover those topics that could have the most relevance to the cognitive functioning of the early adolescent as it relates directly to learning and indirectly to curriculum design. From the available mass of studies on cognitive development, the authors selected for review those that reflected several major research and theoretical traditions such as the mental test movement, the Genevan and the Vygotsky-Luria Schools and the "cognitive styles" approach.

Schools should be acutely aware of the needs and characteristics of emerging adolescents that have their sources in the developing cognitive and intellectual functions. The early adolescent's intellect is undergoing profound and lasting changes from ages 12 to 16 and unless educators understand some of the dynamics and expressions of the evolution of the adolescent's intellect and is successful in confronting him with a well-planned challenge to his rapidly changing intellect, only miseducation can take place. This is the message the authors of the report hope to convey to their readers in Chapter three.

In the last chapter, the authors present a comprehensive review of current professional literature on developmental patterns revealed by empirical research. Although mention is occasionally made of clinical studies describing conditions of severe deviations these are kept to a minimum in favour of studies which present a wide informational base on the normal expectations for the emotional and social development of adolescents.

The chapter's organization differs markedly with the preceding chapters. It was felt that the modal-behaviour organization of the data facilitated the identification of the typical behaviour most characteristic of normalcy while at the same time allowed for exceptionality within a normal range.

Thirty-four modal behaviours are delineated on the most numerous group (North-American middle class), with important variations for age, sex, or cultural differences. The empirical evidence cited tends to confirm the concept of developmental tasks as adjustive difficulties which stem largely from the individual's growth potential and the demands imposed by a culture. The home, school and peer sub-culture were found to play prominent roles, often complimentary as well as conflicting, in determining the intensity of adjustive difficulty an individual will experience. Each in its own way has great potential for contributing positively to the adolescent's understanding of the nature of biological change taking place within him at adolescence and to the building of a realistic self-confidence.

The school as a dominant factor in the lives of adolescents was confirmed in this study. Findings suggest that the school is in a particularly strategic position to bolster the self-esteem of the adolescent by giving him increasing opportunity to be of service and to develop responsible outlets for his drive toward independence and new found idealism.

The organizational schema of this chapter has also served to identify the following areas of adolescent development for which empirical evidence is meagre or conflicting, and for which additional research is needed: (1) the causes of heightened emotionality other than biological change, (2) the coping style of adolescents when meeting crises, (3) the origins of adolescent fear and disdain of the school, (4) the affect of changes in cognitive ability on emotional and social welfare, (5) socio-economic differences in self-esteem, (6) the dynamics of peer groups, and (7) sex differences in egocentrism in adolescence.

Within each chapter, and wherever possible, the educational implications were brought out as forcefully as one could. It is, however, expected that curriculum planners and designers for the age groups 12 to 16 interpret the research data of this report in terms of their own schools and communities, that is, that they provide the curricula needed to match the highly variable and changing characteristics of the emerging adolescents and to meet the range of individual differences which makes the intermediate years a unique segment of the educational ladder.

In conclusion, I wish to express my most sincere gratitude to my colleagues who made this study possible, to John Rackauskas, research officer for the project, to Drs. Jerry Vermuth, Vytenis B. Damusis, Floyd R. Smith and Don Stuss. I also wish to acknowledge the untiring

efforts of Hélène Laporte, Nicole Martin and Vivienne LeMesurier whose assistance in the preparation, editing and typing of the manuscript was invaluable. Finally, I wish to express my appreciation to the Ontario Ministry of Education who funded the study.

1 Overview of Adolescent Growth and Development

1. The Meaning of Adolescence

Adolescence is variously described depending upon the point of view of the observer. It may differ in time, culture, and theoretical point of view. The word adolescence derives from the Latin verb adolescere which means "to grow up". Although it may be considered a period of transition we are cautioned by Hurlock (1973), Ausubel (1954), and Osterrieth (1969) that it is not discreet from and unrelated to childhood. Ausubel (1954) declared it axiomatic that the nature of adolescent development is conditioned by childhood experience. The years of adult maturity are influenced in turn by what has occurred in the adolescent period.

Stone and Church (1968) observe that the term adolescence is used in two somewhat different senses: (1) from the point of view of physical development it refers to the age span that begins with the prepubertal growth spurt and ends with the attainment of full physical maturity; 2) psychologically, it refers to a state of mind, a mode of existence that begins roughly with puberty and ends when, as Ausubel says, the individual has attained "executive independence"--that is when the individual has attained emotional and social maturity and has the experiences, ability and motivation to consistently assume the role of an adult (Ausubel, 1954).

The central theme of adolescence is that of identity, which is described by Erikson as the stage in which the adolescent's new-found integrative abilities are used to synthesize all the things he has learned about himself in childhood into a concept of self that makes sense and shows continuity with the past while preparing for the future (Elkind, 1970).

The beginning of adolescence is difficult to determine because the age of sexual maturing varies greatly. It is far more realistic to use physiological indices than chronological age when marking the milestones in adolescence. Puberty, the point in life at which sexual maturation begins, varies widely between boys and girls and for individuals within each sex group. Hurlock estimates that adolescence extends from 13 to 18 years for girls and from 14 to 18 for boys. She further divides adolescence into two periods with the dividing line at age 17 (Hurlock, 1973). In early adolescence the youth is preoccupied with the profound physical changes taking place in his/her body and with expressions of independence which are in contrast to his social dependence of childhood. In addition to sharing the young adolescents' concerns, older adolescents are confronted with adjustments to the adult world of responsibility in matters of sex, marriage, career, politics, and parenthood.

Hurlock includes puberty as an integral part of adolescence, but not synonymous with it. Adolescence includes all phases of maturing, not sexual maturing alone. Not all writers agree with Hurlock. For example, McCandless conceives of adolescence as a psychosocial period of time following puberty and extending to the time of reaching executive independence (McCandless, 1970).

In Hurlock's view puberty is an overlapping period with approximately one-half of it overlapping the end of childhood and the latter half extending into the early part of adolescence. Thus, two years are spent in preparing the body for reproduction and two years in completing the process. The first two years are known as "preadolescence" or "pubescence" and puberty is the point of life at which sexual maturity begins (Hurlock, 1973). The pubescent child is not an adolescent because he is not sexually mature, but neither is he a child because many physical changes and behaviour patterns have been initiated and there is an apparent transformation in process from the childlike features of childhood to those of an adult.

The central tendency for puberty is somewhere between the 12th and 15th year and may occur anywhere between the 9th and 17th year in girls and one or two years later in boys. The precise timing of puberty is a matter of individual growth as affected by both internal and external factors. The last hundred years has seen a noticeable lowering of the average age of puberty.

2. Theories and Other Important Points of View

i. The Nature and Value of Theories

Since the turn of the century there has been a special attention directed toward the adolescent period of development. This attention has generated a vast quantity of research data which is most incomprehensible unless ordered in some systematic way. Theories serve this function. They are best thought of as conceptual models, composed of a cluster of relevant assumptions systematically related to one another of a set of empirical definitions (Hall and Lindzey, 1957). Theories serve the important function of giving us a sense of direction and a means for synthesizing the accumulation of data about adolescence. A good theory:

i. is comprehensive and will account for much behaviour.

ii. is explicit and parsimonious and generates useful research.

A theory is not a law unto itself but a means of predicting laws just as laws may predict events.

Numerous theories have been promulgated in the scientific inquiry on adolescence since the turn of the century. The complexity of the phenomena studied has given rise to many conflicting viewpoints.

All theories accept the assumption that adolescence is a unique phase in development and incorporate essentially the same data on biological and physical changes. Where they differ, however, is on the influence of the biological changes on the psychological processes.

Current major theories of adolescence may be classified as biological, psychological, psychosocial, sociological and anthropological (Beller, 1968).

ii. Biological Theories

G. Stanley Hall, the father of the psychology of adolescence was the first theorist of consequence to address himself to this phase of human development. His theory is considered biological in that it accounts for change of psychological adjustment, through biogenetical programming, expressed through the process of maturation. In Hall's theory there was little room for environmental factors. Although he was not completely oblivious to cultural influences, he none-the-less clung to the belief that behavioural changes occurring during this period of growth were completely conditioned by physiological events dependent on the function of the endocrine glands. A major assumption in Hall's theory, stimulated in large measure by Darwin's concept of evolution, is the concept of recapitulation. By this view the experiential history becomes a part of the genetic structure of the individual (Muuss, 1968). Accordingly, the individual passes through stages comparable to those of the history of mankind. Hall prescribed resigned acceptance of these unfoldings and described adolescence as a period of inevitable "sturm und drang" (Hall, 1916).

Arnold Gesell, like Hall, developed a theory of maturationally determined reoccurring cycles of behaviour. His theory is characterized as morphogenetic in that "environmental factors facilitate or inhibit growth, but the basic direction of growth is laid down by maturational forces" (Beller, 1968). Gesell was one of the foremost exponents of systematic and detailed empirical observations of development at various stages from infancy through adolescence. Important in his construct of development are maturationally determined reoccurring cycles of innovation, integration and equilibrium. Growth in such a system consists of oscillations in a spiral manner toward an equilibrium and partial regressions as a staging for future progression. This "reciprocal interweaving" (Gesell, 1956) gives us a description of adolescence as consisting of vivid contradictions of behaviour at different age levels. During the periods of innovation and unresolved integration those dealing with adolescence may anticipate difficult behaviour. In the periods of equilibrium a sense of equanimity will occur.

Additional biological theories are those of Kretschmer's bodily types and Zeller's body gestalt which are reviewed by Beller (1968).

iii. Cultural and Sociological Theories

More than any other group the cultural anthropologists have challenged the assumptions of the biological point of view. In 1925, Margaret Mead assembled a large body of data dealing with comparative psychology of adolescence. Her studies of Samoan culture made it apparent that the adolescent experiences in Western civilization were not inevitable and that there were degrees of conflict, stress and difficulty (Mead, 1928). Culturally-oriented theorists in the main hold that cultural conditions are the determining factors as to whether human development will occur in stages or is continuous.

Ausubel (1954), while crediting the cultural anthropologists with the correction of the ethnocentric bias of the biological point of view, finds them erring in another direction. He states that because the cultural theorists

> ...were able to relate degrees of adolescent conflict to cultural conditions, they jumped illogically to the conclusion that the entirety of adolescent psychology could be regarded largely "as the product of norms and restrictions in the child's surroundings which deny, postpone or regulate sex and other activities of which he is capable as a maturing person".

iv. Psychoanalytic Theory

Psychoanalytic theory fits into neither biological nor cultural types. The classical psychoanalytic theory did emphasize the importance of biological factors; however, later psychoanalytic theorists such as Erikson have given much more attention to the importance of culture and environment. Erikson's psychosocial stages of ego development are an extension of the basic Freudian psychosexual stages and provide for continuity in personality development throughout the entire life span. The following presentation of developmental stages, Table I, equates Erikson's psychosocial stages with Freud's psychosexual stages (Biehler, 1974).

Harry Stack Sullivan, like Erikson, made some important extensions of psychoanalytic theory. Of particular significance to adolescent psychology is his emphasis on interpersonal relationships and their affect on the development of the self-concept. Implicit in Sullivan's (1953) interpersonal theory are these generalizations: a positive self-concept results from an atmosphere of approval and support; a negative self-concept results from negative appraisals.

Psychoanalytic theory as it has developed in recent times puts a greater emphasis on external reality. To illustrate, Conger cites Anna Freud's recognition of opportunities in adolescence for correcting previous adverse experiences and Otto Rank's emphasis on the conscious ego as opposed to the unconscious level in the creative and productive aspects of human nature (Conger, 1973).

v. *Psychological Theories*

The distinguishing gesture of psychological theories of adolescence is their focus of attention on psychological processes as important mediating factors in adolescent development. Prominent among such theorists are Kurt Lewin and Edward Spranger. Their

Table I. Developmental Stages According to Erikson and Freud

Erikson's psychosocial stages	Age range	Freud's psychosexual stages*
Trust vs. Mistrust. Adequate care and genuine affection lead to view of world as safe and dependable. Inadequate care and rejection lead to fear and suspicion.	Birth to 1 year	*Oral Stage.* Mouth region provides greatest sensual satisfaction. Unfortunate experiences causing a fixation at this level may lead to greed and possessiveness or verbal aggressiveness.
Autonomy vs. Doubt. Opportunities for child to try out skills at own pace and in own way lead to autonomy. Overprotection or lack of support may lead to doubt about ability to control self or environment.	2–3 years	*Anal Stage.* Anal and urethral areas provide greatest sensual satisfaction. Unfortunate experiences causing a fixation at this level may lead to messiness, extreme cleanliness, or frugality.
	3–4 years	*Phallic Stage.* Genital region provides greatest sensual satisfaction. Unfortunate experiences causing a fixation at this level may lead to inappropriate sex roles.
Initiative vs. Guilt. Freedom to engage in activities and patient answering of questions lead to initiative. Restriction of activities and treating questions as a nuisance lead to guilt.	4–5 years	*Oedipal Stage.* Parent of opposite sex is taken as object of sensual satisfaction—which leads to tendency to regard same-sexed parent as a rival. Unfortunate experiences causing a fixation at this level may lead to competitiveness.
Industry vs. Inferiority. Being permitted to make and do things and being praised for accomplishments lead to industry. Limitation on activities and criticisms of what is done lead to inferiority.	6–11 years	*Latency Period.* Resolution of Oedipus complex by identifying with parent of opposite sex and satisfying sensual needs vicariously.
	11–14 years	*Puberty.* Integration of sensual tendencies from previous stages into unitary and overriding genital sexuality.
Identity vs. Role Confusion. Recognition of continuity and sameness in one's personality, even when in different situations and when reacted to by different individuals, leads to identity. Inability to establish stable traits in perception of self leads to role confusion.	12–18 years	

From Robert F. Biehler, Psychology Applied to Teaching, Boston, Houghton Mifflin Co., p. 109, 1974.

*The description of Freudian Stages in this table is derived from Elkind, p. 397

theories are built on studies of individual human experience with particular attention to states of consciousness, perception, values, inner conflict and stress. Lewin's central concern was in searching for an understanding of the organismic behaviour resulting from dynamic interaction between a person and his environment. The core concept of his theory is represented in the formula: Behaviour (B) is a function of the person (P) and his environment (E). In this formula both P and E are interdependent variables. Thus to understand an individual one must consider both the individual and his environment as they interact.

Edward Spranger emphasizes the discovery of the ego and the totality of the psychic structure. He is very much in tune with gestalt psychology and is primarily concerned with inner determinants and the individual's experience and conception. His point of view, called the Geisteswissenschafliche theory, is very influential in Europe (Conger, 1973). Spranger has resolved the issue between stage development vs.,continuous development and heightened emotionality by stating that adolescent development may take on different patterns in individual cases. He has proposed three distinguishing patterns of adolescent development (Conger, 1973).

> The first pattern, which corresponds to Hall's idea of adolescent development, is experienced as a form of rebirth in which the individual sees himself as another person when he reaches maturity. This is a period of storm, stress, strain, and crisis, and results in personality change. It has much in common with a religious conversion, also emphasized by Hall.

> The second pattern is a slow, continuous growth process and a gradual acquisition of the cultural values and ideas held in the society without a basic personality change.
>
> The third pattern is a growth process in which the individual himself actively participates. The youth consciously improves and forms himself, overcoming disturbances and crises by his own energetic and goal-directed efforts. This pattern is characterized by self-control and self-discipline, which Spranger related to a personality type that is striving for power. This system of the three forms of developmental rhythm incorporates older, controversial issues, such as Hall's "erratic form" of adolescent development as well as Hollingworth's "gradual form". It considers them both possible. It allows for various developmental rhythms within a given culture (Muuss, 1969).

vi. A Psychobiological-Psychosocial Theory of Adolescence

Ausubel's attempt to provide a theoretical framework for the accumulation of research data at mid-century provides a useful syntax with which to reconcile, in part, the extreme biological and cultural views on adolescence. Adolescence is identified as a distinctive stage in personality development precipitated by significant changes in the biosocial status of the child (Ausubel, 1954).

As these changes represent a discontinuity with previous biosocial conditions, extensive reorganization of personality is essential. Ausubel differentiates between adolescent problems which relate to general developmental trends which are universal in distribution and those problems wholly conditioned by cultural factors and modes of control peculiar to a given culture. He has empirically defined the former as psychobiological in origin and the latter as psychosocial. McCandless (1970) has captured the essence of Ausubel's position in the following succinct definition of terms:

> The psychobiological aspects of adolescence refer to those factors that are universal (Ausubel, 1954) and independent of the culture in which an adolescent develops, such as sexual maturity, increases in height, weight, and strength, development of secondary sex characteristics, and alteration of self-concept and social status. These factors demand personal and social changes, regardless of whether one lives in America, Pakistan, or Dahomey. Becoming tall and strong, like one's father or mother, necessitates making changes in one's way of life in all societies and change of a personal and social nature demands of the adolescent new ways of adaptation, or socialization. Culturally differential ways of adapting to universal factors in adolescence constitute the psychosocial aspects of adolescence.
>
> Reaching mature or nearly mature height and strength psychobiologically means that one now does things for himself that formerly were often done for him. But the specific things he does are psychosocial in nature, and culturally determined (McCandless, 1970).

The following reasons for a common core of psychobiological problems in adolescence in a wide range of cultures is extracted from an extensive discussion of this matter in Ausubel (1954).

1. Adolescence is universally a transitional stage in personality development. Transitional periods by their very nature share many properties in common and generate characteristic constellations of psychological problems that inevitably arise when individuals are confronted by radical changes in their biosocial status.

2. A second source of psychobiological uniformity in the problems of adolescent development is to be found in the common group of physiological and anatomical changes that are everywhere associated with the occurrence of adolescence. These changes give rise to new

types of drives, emotions, and stages of awareness.

3. Almost with no exceptions, the age of pubescence is culturally recognized as the appropriate time for initiating the changes in personality status that are characteristic of adolescence.

4. The nature of adolescent development in different cultures will be comparable because certain very important aspects of personality maturation depend upon childhood experience with parent attitudes that are universal in distribution.

5. The universality of the various adjustive techniques available to adolescents in meeting disequilibrium induced by new status problems; repression, aggression, withdrawal, projection, compensation, displacement. Again it is undeniable that the choice, the frequency, and the precise form taken by these mechanisms will vary, depend upon differences in cultural tolerance for different types of defensive behaviour. But these reactions are such a basic part of the adaptive repertory of human beings that individual preferences resulting from unique factors of constitution and early background cannot be completely avoided (Ausubel, 1954).

Ausubel defines psychosocial problems as follows:

In the realm of psychosocial problems belong those more specific aspects of adolescent development that are especially conditioned by the special nature of the cultural environment. Here we are concerned with factors accounting for differences rather than for uniformities in the developmental process among cultures (Ausubel, 1954).

3. Goals of Adolescence

As the primitive society uses the period of puberty as a period of special preparation of boys and girls for adult life, so the modern society uses the longer period of adolescence for the preparation of adolescents to meet the special requirements of adulthood in a modern technological society. The goals of adolescence in a complex modern society are determined in great measure by the individuals growth potential and the demands placed upon him by the culture. The changes that take place in adolescence are both developmental and cultural. They are guided by the adolescents own nature and the cultural expectations. The individual enters adolescence with a child's adjustment and leaves it with the adjustment of an adult. Conger observes that "it is fair to say that adolescence begins in biology and ends in culture". With the biological changes accompanying this emotional, social and intellectual development, a child who is normally dependent on others is at the end of adolescence "ready to leave his home--emotionally and actually--to maintain himself, to manage his own social contexts, make up his own mind, establish his own home, and to concern himself with the general principles behind service phenomena" (Cole and Hall, 1970). The following table adapted by Cole and Hall from a list of goals by Lewis L. Judd enumerates nine goals of adolescence:

Goal 1: Achievement of independence, especially emotional, from home.

Goal 2: Establishment of identity, as a person.

Goal 3: Development of self-motivation.

Goal 4: Establishment of a set of values and enough self-control to adhere to the values selected.

Goal 5: Development of an interest in and sympathy for other people as individuals.

Goal 6: Acceptance of sexual role and adequate heterosexual interests.

Goal 7: Development of added intellectual powers.

Goal 8: Acquisition of skills that will lead to self-support.

Goal 9: Development of satisfactory relations with his age-mates.

Ausubel observed that most theorists while disagreeing in areas such as the origin of changes, whether biological or cultural, are virtually unanimous in agreeing on the primary developmental tasks of adolescence. The developmental tasks are conceived as adjustive difficulties. There are three sources of developmental tasks: 1) physical maturation, 2) expectations of the culture and 3) the individual's aspirations. A very popular statement of developmental tasks was presented by Havighurst in 1953 (Horrocks, 1962). He listed 10 tasks of the adolescent period as follows:

1. achievement of new and more mature relations with age-mates of both sexes
2. achievement of a socially approved masculine or feminine social role
3. acceptance of one's physique and the effective use of the body

4. achievement of emotional independence of parents and other adults

5. achievement of the assurance of economic independence in the sense of feeling that one could make one's own living if necessary

6. selection and preparation for an occupation

7. preparation for marriage and family life

8. development of intellectual skills and concepts necessary for civic competence

9. the desiring and achieving of socially responsible behavior, and

10. acquisition of a set of values and an ethical system as a guide to behavior.

Corey (Ausubel, 1954) has produced essentially the same in a more condensed listing. Adolescents he states must

1. learn to accept and come to terms with their own bodies
2. learn an appropriate sex role
3. establish independence from adult (particularly parental) domination
4. achieve adult economic status, and
5. develop a system of values.

Zaccaria (1969) has made an interesting synthesis of three somewhat different formulations of developmental tasks. He declares that combining the general developmental tasks formulated by Havighurst, the vocational developmental tasks of Super and Erikson's psychosocial crises into a comprehensively woven pattern will provide a set of goals that will facilitate face-to-face relationships with individuals such as those occurring in guidance.

4. Psychological Consequences of Biological Change

If we are to clearly understand the psychological behaviour of individuals as they progress through adolescence, it is essential that we have an awareness of the biological changes underlying much of their emotional and social behaviour. Chapter II of this report provides a detailed and lucid examination of the major biological changes occurring in the adolescent. A brief overview here will serve to highlight the complexities involved.

i. Physical Growth

After a period of slow growth there is a spurt of rapid growth about six months before puberty. Of major importance in puberty is the onset of hormonal activity from the endocrine glands. The action of these glands serves to stimulate physical growth, sexual maturation and other physiological development. The pituitary gland is central in the orderly regulation of growth principally through the gonadotropic and coricotropic hormones which have a stimulating effect on other endocrine glands which in turn release their own growth related hormones (McCandless, 1970). The increased amount of hormonal production, particularly that involving the adrenal cortex and the gonads is differentiated between the sexes: the males producing more androgens, and the females more estrogens.

The growth spurt refers to the acceleration in the increase in height and weight. It will vary widely in intensity, variation and age of onset. Sex differences in physical development are observed early in adolescence. Though there are differences in the timing of growth and bodily configuration of boys and girls, the sequence within each sex is rather consistent. Girls will go through the sequence about two years earlier than boys and may for a time exceed the boy in both weight and height. Other manifestations of the earlier maturation of the female is found in the more rapid dentition and earlier occurrence of myopia and skeletal maturation. The sequence of events in the physical growth is graphically portrayed in Figure 1.

For the hypothetical average boy the first change at age 12 is enlargement of the scrotum and testes. The apex of the height spurt is reached at age 14 and the entire process is completed by age 16 or 17.

In the average female the earliest change is the appearance of the breast buds followed rapidly by widening of the pelvis and appearance of pubic hair. The apex of the height spurt occurs at about age 12 with the menarche following. In a 1950 study the average age of menarche was 13.3 years (Tanner, 1962).

Girls complete the pubescent process in about three years, a full year less than do the males. Fertility is not usually established immediately after the menarche and may not occur for a year or a year and a half.

There is a positive relationship between skeletal maturity and sexual maturity.

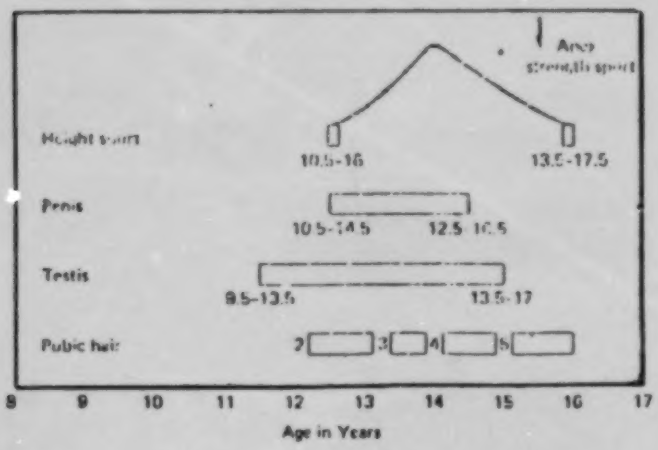

Diagram of sequence of events at adolescence in boys. An average boy is represented; the range of ages within which each event charted may begin and end (and stages in their development) is given directly below its start and finish. (From W. A. Marshal and J. M. Tanner. Variations in the pattern of pubertal changes in boys. *Arch. Dis. Child.*, 1970, 45, 13. By permission.)

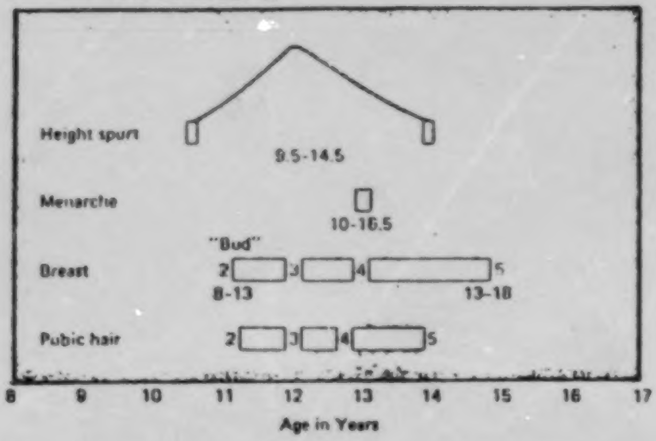

Diagram of sequence of events at adolescence in girls. An average girl is represented; the range of ages within which some of the events may occur (and stages in their development) is given by the figures directly below them. (From J. M. Tanner. *Growth at adolescence*. Oxford: Blackwell; Philadelphia: Davis, 1962 [2nd ed.]. By permission.)

Figure 1. Physical Growth and Physiological Development in Adolescence (taken from John J. Conger, Adolescence and Youth, New York, Harper and Row, p. 103, 1973).

Physiological changes in the cardiovascular and respiratory systems and changes in metabolism generally parallel the bodily growth taking place in the individual. These and other changes taking place in the neural and digestive system of the adolescent are of vital importance in conditioning the behaviour of the individual. Changes in the circulatory system are of profound importance. During adolescence the heart weight nearly doubles, with growth of the heart in boys more rapid. There are also changes in size and tension of the arteries. Blood pressure increases steadily to about age seventeen (Cole and Hall, 1970). From about age 10 to 13 girls have a slightly higher average blood pressure than boys; after 13, boys tend to exceed girls. The average pulse rate, conversely, decreases with age for both sexes. The average for girls is, at all ages, somewhat higher than that of boys.

There is considerable growth in the organs of digestion during the adolescent period. The stomach becomes more elongated and attains a greater capacity. Adolescence also sees a substantial increase in the size of the lungs. This is particularly true of boys. Girls have smaller lungs.

Records of the past hundred years or more suggest a secular trend in earlier onset of growth in height and weight and sex maturation as evidenced by the first menstruation.

Conclusions that a relentless evolutionary trend is occurring may be premature. The Hansman (1972) study cited in Chapter II, on page 87, suggests that the secular trend in menarche may be an artifact. Hansman notes that the lower limits of the range have not changed, while the upper limits have been lowered thus producing the effect of lowering the average menarcheal age. Forbes (1968) suggests four plausible reasons for the secular trend. First, it is possible that we are observing a rebound phenomenon in that prior to the industrial revolution the children were up to today's size, but because of the adverse social and economic and nutritional factors in the revolution growth in general was stunted. A second hypothesis is that of hybrid vigour, which suggests that where genetic hybrids occur recessive genes would be less likely to be expressed. Still a third view is that the decline of chronic disease and improved medical attention has prevented stunting diseases. A fourth view, and the one most popular with Forbes, is the improvement of nutrition. Influence of nutritional differences is also the most popular among other authors writing on adolescence (Cole and Hall, 1970), (Conger, 1973).

ii. Misconceptions about Adolescent Growth

Blair and Jones (Purnell, 1970) identify several misconceptions abroad about physical development in adolescence. They are:

1. the universality of awkwardness in adolescents. Blair and Jones suggest that it is more an adult anticipation than actual. In fact, adolescents typically learn physical skills and body control with facility.
2. the idea that warm climates accelerate maturity. There is evidence that it is more likely to be affected by diet and health than climate.

3. the fear that vigorous exercise will damage the heart. Blair and Jones find that this assumption, based on the increase in size of the heart and the strength of blood pressure increases, has not been borne out by fact.

4. the academically able youth are inclined to be "motor morons". Blair and Jones assert that most evidence indicates positive correlation between physical and mental development.

Conger feels that the most plausible hypothesis concerning the earlier development in height, growth and sexual maturation, is in fact a reflection of the individual's general physiological state throughout the entire developmental period. He cites examples from studies in World War II where the age of menarche was significantly retarded in some European countries. The earlier maturation possibly reflects ideographical variables rather than a relentless, ongoing evolutionary process. There undoubtedly are ultimate biological limits for a given population. Conger suggests that the biological limits for the average menarche for European populations would be around 12¼ years (Conger, 1973).

Forbes (1968) wonders if the accelerated growth rates and nutritional abundance may not at some future date work adversely on the individual, producing arterial and degenerative diseases in adult life.

5. Psychological Affect of Physiological Changes

The radical changes taking place in the body during adolescence have psychological as well as physical implications for the individual.

Ausubel (1954) used the term "psychobiological" in referring to the psychological consequences of biological change. In looking at this particular aspect of adolescent development, our attention is focused on the effects of physical growth on the concept of self, sexual identity and sexual behaviour of the individual, and the consequences of early or late maturation.

i. Self-Concept and Physical Change

Hurlock (1973) observes that one of the most difficult developmental tasks during adolescence is the acceptance of changes taking place in body and physique. Dissatisfaction with appearance is generally at its greatest shortly after sexual maturity. The concern one feels at this time originates with the physical change, but is influenced by a number of factors. The adolescent's image of himself, for example, can be influenced greatly by the attitudes within the family and among his peers. Hurlock has an excellent summary of the effects of body changes and the factors influencing these changes (Hurlock, 1973).

1. Rapidity of Change--Rapid growth and physical change so alter the body that the adolescent who cannot readily accept his new physique and revise his physical self-image may become overly self-conscious.
2. Lack of Preparation--How much knowledge and forewarning the adolescent has of the changes taking place in his body will markedly influence his attitude toward the changes.
3. Childhood Ideal--Any feature that greatly deviates from the adolescent's childhood ideal of himself as a grown-up will be a source of concern.

4. Social Expectancy--The adolescent's attitude toward his body and facial features is influenced by what he believes the significant people in his life, especially parents and members of the peer group, think of them.

5. Stereotypes--Body builds or facial features associated with unfavourable stereotypes of the adolescent lead to unfavourable self-concepts and unsocial behaviour.

6. Social Insecurity--The adolescent knows that physical appearance affects social acceptance. A physical feature that is unfavourably judged will make the adolescent socially insecure.

Most adolescents seem to have idealized norms for physical appearance and skills. These are usually formed from culturally determined stereotypes of masculinity and femininity and marked variations from this idealized person can be quite serious to the adolescent. Discrepancies in the idealized self and the perceived self in terms of physical characteristics will often cause the average adolescent to be sensitive, even critical of his changing physical self. Conger (1973) cites studies to support observations that physical characteristics are mentioned more than any other characteristics in response to what one disliked most; likewise, Conger observes that "the adolescent who perceives himself as deviating physically from cultural stereotypes is likely to have an impaired self-concept". In general, girls show more concern about their appearance. The major concern adolescents show about their physical development centres around three questions:

1. Am I normal?
2. Am I sex appropriate?

3. What can I do to make my body come up to my childhood ideal? (Hurlock, 1973)

It is important to keep in mind that psychological attitudes can also influence the self-perception of physical appearance. Previous experiences may cause an adolescent to see himself as attractive or unattractive, strong or weak, masculine or feminine, irrespective of the actual facts of his adolescent physical appearance and capabilities (Conger, 1973). Conger observes that guilty feelings about something such as masturbation may result in the adolescent finding evidence of physical abnormalities ranging from acne, circles under the eyes or fatigue or even deformities in appearance of the sexual organs, none of which have any objective base. A girl who has been told for years that she looks like a parent she does not admire may view herself as being unattractive even though the objective fact may be that, according to the cultural stereotypes, she is quite beautiful (Conger, 1973).

The perceptions adolescents have of their physical appearance can work to their advantage as well. Overall self-esteem of the individual can be enhanced if the young person meets the cultural standards of physical appearance and ability and has the approval of peers and adults whose opinions he prizes. Girls tend to be more concerned about their physical development than boys and Conger suggests that this is because their outward appearance and their inner self-image are more closely bound together than they are for males. Much of the transitional anxiety identified by Ausubel occurs as the result of the individual's reaction to his physical self. The degree that a healthy, well-proportioned, strong and graceful body and an attractive face will reduce the tensions produced by change, the less the individual will experience the storm and stress of adolescence. This area of reaction to one's physical self is the source of much heightened emotion. McCandless (1970) maintains that the role of the body in social and personality development is something that has been neglected by studies of psychologists and sociologists. He thinks that psychologists and sociologists may be naively optimistic about the environment and the socialization process and what they can do for human development under most ideal circumstances. However we must keep in mind that the theories of Kretschmer and Sheldon and their colleagues on bodily types and personality development have not fared too well under careful scientific scrutiny. Other physical matters of serious concern for boys and girls are:

1. mature height
2. bodily shape
3. weight, whether excessive or not
4. the proportions of the face
5. secondary sex characteristics.

Primary and secondary sex characteristics have a profound effect upon self-concept. A boy judges his masculinity for himself in Western culture particularly by the size of his penis and the extent of his pubic and body hair as well as his somatic changes in height and weight. Virility is commonly equated with early maturity and size of the genitals (McCandless, 1970). A source of temporary conflict for males can be seen in a diagram from Conger, Figure 1, page 19, where it is observed that a considerable number of boys may experience rapid testical growth accompanied by abundant pubic hairs before they enter their growth spurt. From their own personal observations they are men, but to the external world they still have the appearance of a boy. Conger (1973) observes that "the discrepancies between their private image of themselves as men and society's belittling--and infuriating--continuing perception of them as boys may lead to seemingly incongruous behavior". Girls to the extent that breast development and slimness are exalted by the cultural stereotype may place an inordinate emphasis upon these physical features. "Body cathexis" (Hurlock, 1973) or feeling of satisfaction with the body is more important to girls than to boys. The girl who is unsatisfied with the transformation in puberty may develop feelings of anxiety and insecurity. In extreme cases where the body image becomes incompatible with the new perception there may be a desire for extensive restructuring of the body image. Jersild states that "the relationship between an attitude and physical appearance is apparent when a person clearly is trying to falsify his or her appearance, as happens when a girl's dyed hair or false eyelashes give her an artificial look (Jersild, 1954)". In extreme instances an adolescent may seek plastic surgery, special contact lens or glasses with stylish frames and indulge in rigorous dieting. Acne, a common affliction in adolescence, can be a tormenting source of anxiety for the young person who is very conscious of his or her appearance.

ii. Development of Sexual Behaviour

Although sex identification begins prior to adolescence the glandular changes of puberty heighten the distinction between the sexes. As with almost all of the higher species there is little sex variability genetically determined. Although these changes are stimulated initially by internal conditions, mature adult sexuality involves more than just these physical changes that occur in puberty. During adolescence the individual must learn new interests and attitudes, new patterns of behaviour. He must master several tasks: acquire knowledge about sex and approved sex roles, learn approved patterns of sex behaviour, achieve socially approved values as a guide to fulfilment for his needs for intimacy, and learn to play the approved role for members of his sex. Hurlock (1973) declares that normal adult sexuality means heterosexuality in which interest and affection are focused on the members of the opposite sex. The social factors will determine to a large extent how heterosexuality will be expressed. The physical changes in the individual, the development of primary and secondary sex characteristics, give direction but do not give full expression of one's sexuality. The role played by the sex hormones in identifying sex differences is not clear. Scientific studies in recent times have dealt with the issue but proofs have not been forthcoming. Hamburg and Lunde (1966) in

Wattenberg (1973) sum up the present position of our knowledge on the subject as follows:

> "Even though there is at present little firm evidence that sex hormones do play an important role in the development of human behavioral sex difference, there are intriguing possibilities to be explored in this area. Recent investigations in a variety of disciplines suggest that complex interactions among genetic, hormonal and environmental factors determine the development of sex differences in human behavior" (Hamburg & Lunde, 1966).

Social factors play a major role in determining how heterosexuality will be expressed. Margaret Mead (1961) has identified some common cross-cultural sexual careers. The major ones most applicable to modern man are summarized as follows:

1. Wife and motherhood--is the commonest sexual role in United States culture (Douvan and Adelson, 1966) indicate that preparing for and achieving this role is the major preoccupation of adolescent girls in all social classes and ethnic background.

2. Role of the adult male who will beget and provide for his children is modal for male (Douvan and Adelson observed less preoccupation among adolescent boys with their future adult role as seen with the girls.)

3. The adult male who will not marry but will exercise some sort of prescribed social function--celibacy with or without religious connotation, sexual abstinence, renunciation of procreation, are some of the forms this role may take.

4. The adult female who will neither marry or produce children but has status in a religious context, nun.

5. In some cultures adult male who assumes institutionalized female roles, transvestism.

6. In some aspects of society females assume male roles.

7. In some cultures non-procreative ceremonial roles are important.

8. The sexually mutilated persons--may be either congenital or socially created--in such cases society expects non-marriage, non-parenthood.

9. Professional and commercial prostitution as found in societies such as the United States. In most cultures chronological age is differentially related to expectations for sexual behaviour.

The age at which sexual maturity occurs and the speed of its onset will have an effect on heterosexual interest. This transition to heterosexuality is often a source of heightened emotionality. The evidence seems to very strongly suggest that learning plays a very important role in heterosexual development and that the individual needs knowledge about sex and opportunities for learning appropriate sex roles. The essential environmental conditions for appropriate heterosexual development are set forth by Hurlock (1973) as follows:

1. There must be a sufficient number of members of the opposite sex of appropriate age, intellectual status and personality adjustment available to give the adolescent an opportunity to select congenial companions and to have pleasurable social contacts with them.

2. There must be an encouraging, sympathetic and helpful attitude on the part of parents and other adults (Hurlock, 1973).

In a study by Shipman (1968) reported by Hurlock (1973) it is interesting to note that the age for acquiring knowledge considered adequate and important for marriage among girls occurs somewhat later than the menarche.

In his study of boys, Offer (1969) observed that a majority of teen-agers are conservative and restrained in their sexual behaviour contrary to what they might verbalize. Whereas only ten per cent of subjects had sexual intercourse by the end of the junior year, their expression of acceptance was quite liberal. Eighty per cent approved of premarital sexual intercourse; however they stipulated that it be after high school. The fear of pregnancy was indicated as the greatest deterrent.

Recognized phases of heterosexual behaviour in American culture follow a sequence, according to Hurlock (1973), beginning with crushes and hero worshipping and proceeding through puppy-love, dating, going steady, engagement and finally marriage. Offer (1969) concludes that the modal adolescent has been limited in his range of sexual experiences and finds that sex education has been given in rather a haphazard way. McCandless (1970) cites an example of the major amount of misinformation that youngsters have about masturbation. Although it is known that physical ill-effects will not result from masturbation in and of itself, a number of youngsters do suffer because of their feelings of guilt and impaired self-esteem. They are victims of the common folklore.

Middle-class culture places an important emphasis upon sexual repression. It is one of the most acceptable methods for handling sexual interest and urges even though middle-class adolescents are most frustrated sexually. Ausubel (1954) minimizes the relationship between the severity of sex restriction and the amount of conflict a youngster may experience. Thus he concludes that heightened emotionality over this matter would occur only if and when the adolescent has internalized the values of his culture. Although adolescents are frustrated sexually, McCandless (1970) observes that there are advantages within the middle-class structure which compensate for such frustration. For example, adolescents are accorded a psychosocial moratorium on responsibility and the protection by parents and authorities from the disastrous long-term consequences of mistakes and active parental support in developing competencies of value in an industrial society are compensatory conditions that balance the emotional tensions to some extent.

However, the attitudes of adults toward adolescence might be improved if they are reminded that control of expression of biological drives, when quite possibly at their strongest, requires no little amount of psychological energy.

6. Psychological Affect of Changes in Cognitive Functioning

Any effort to understand early adolescence must of necessity consider adolescent intellectual structure and capacity as well as mental development and process, for these cognitive factors mediate the behavioural relationship the adolescent establishes with his material and social environment. In addition, adolescent intellectual functioning shows a demonstrable relationship to physiological characteristics and the adolescent's social-emotional behaviours.

i. Research Orientations

Four research orientations provide a relatively comprehensive view of early adolescent cognitive development and capacity. One content area is an outgrowth of the mental test movement's measurement orientation and attempt to chart intellectual growth over the life span. Another approach is firmly grounded in the theory and research of J. Piaget and his Geneva School associates who describe and seek to explain developmental regularities and discontinuities in qualitative cognitive transformations occurring during early adolescence. A third orientation stems from the work of Vygotsky which holds valuable implications for adolescent cognitive functioning. A fourth orientation emerges in the contemporaneous and energetic research into the question of cognitive styles, individual differences as reflected in and influencing the manner in which information is received and processed.

All four areas of study are reviewed with the broadly framed objective of developing an empirically valid portrait of adolescent cognitive functioning amenable to the needs and concerns of educational practice. By cataloguing and providing a broad base of information and data gathered in the research conducted by these four approaches, a characterization of early adolescent thought is anticipated which implicitly and explicitly allows for recommendation and implementation of refinements in educational policy and instructional approach.

Only recently have studies in adolescence been revitalized as content of legitimate scientific concern. Since G. Stanley Hall's (1904) time adolescence as a research topic important in its own right had failed to capture many adherents. Dormancy and suspension of direct interest in adolescent issues, particularly cognitive processes, earmarked the epoch between Hall's achievements and the 1950's. Fundamentally, the sources of this disregard of adolescent concerns included a diversion and emphasis of interest in other developmental epochs, as well as a conspicuous absence of a systematic theory accounting for adolescent behaviour and functioning. Developmental discontinuities in adolescent behaviour were subordinate to perceived regularities, with little substantive research available to clarify fundamental developmental issues.

A number of major factors share the responsibility in the current reversal of this trend of disregard, most significantly, the prolific outpouring of work by J. Piaget and his associates.

The increased availability of Piaget's theory and research in English translation (notably for adolescence, Inhelder and Piaget's The Growth of Logical Thinking) changed the up to then defined landscape of adolescent cognitive functioning. Piaget's unique observations and descriptions of the development of profound qualitative transformations in early adolescent thought stimulated numerous controversial and exciting issues in cognitive processes generating a considerable body of argumentative as well as replicatory research.

In fact, few studies of cognitive development are contemplated and conducted today without some consideration of Piagetian concepts and insights.

Another factor responsible for the regeneration of interest in adolescent cognitive development was the increased demand by educators for data useful in the creation and implementation of new educational programs. Often expressing disenchantment with the state and pragmatic usefulness of information characterizing adolescent cognitive functioning, they impressed many researchers to gather data identifying the parameters of adolescent thought and intelligence which could serve as the basis for program construction and development.

ii. Trends in Research on Adolescent Cognitive Functioning

Since the beginning of this century two historically distinct and methodologically different trends characterized research into adolescent cognitive functioning. Both trends, while discrete, overlapped in many of their observations. One historical approach was embodied in the mental test movement's devotion to methodological rigour in the construction and validation of indices designed to measure intellectual ability. The other approach, the qualitative-developmental, less bound by methodological and measurement considerations, generated a comprehensive description of profound qualitative changes in adolescent cognitive development.

Through the 1950's, the undisputed purveyor of intelligence and intellectual capacities in children and adults was the psychometrician with his measures. From Binet through the 1950's, he embraced and nurtured the intelligence test as the solitary vehicle for describing and explaining intellectual functioning. Substantive questions as to the nature and mechanisms in cognitive information processing were deferred and subservient to the search for items and the construction of tests which could define intellectual differences reliably and validly.

In the course of developing mental tests and procedures for assessing intelligence the mental test movement was capable of generating, as byproduct,a wide array of observations useful in establishing a basic, yet by virtue of the approach, static picture of intellectual capacity and its development. The limitations of their instruments artificially restricted the substantive description of cognition. Characteristically, volumes of research were produced emphasizing normative trends in intellectual growth mapped by responses of representative age groups to devised measures of intelligence.

Scores of studies were compiled assessing the stability of measured IQ over time, the age of cessation in measurable mental growth, the impact of selected individual difference variables such as sex and socio- economic class on measured IQ and with further refinement of their measurement strategies, the differentiation of mental abilities with increasing age. Study of adolescent cognitive functioning is a beneficiary of their efforts, not because of any direct concern with adolescent psychological processes per se, but because these measurement-based issues required the study of the entire life span.

Earlier psychometric studies of adolescent cognitive ability and mental development (see Brooks, 1933, 1936, 1939) do not deviate significantly from studies conducted in the 1950's (see Ferguson, 1954). In fact, Ferguson contends that the mental test movement's enterprise reached an asymptotic level in the 1950's since by then the fund of information regarding mental capacity and growth which could be assessed using intelligence tests had been most effectively tapped. These considerations are not to be taken as a disparagement of the utility of intelligence testing, but merely a cautious reminder that knowledge of performance on an IQ test severely limits and often camouflages tremendous cognitive strides made during different developmental periods, adolescence included.

That measured intelligence offers the educational practitioner invaluable information descriptive of student capability is unchallenged. Correlates of measured intelligence are often the achievements which a traditional educational system attempts to facilitate and improve. For example, Day (1968), using Canadian seventh and eighth-graders as subjects, correlated their IQ's as measured by the Dominion Group Test of Learning Capacity (Intermediate) with their scores on end-of-term examinations. It was found to correlate .67

with comprehensive examinations in English literature, .64 with English language and vocabulary exams,.61 with history, .53 with mathematics, .53 with science, and .41 with geography. Numerous additional studies are available which generally support these observed relationships between IQ and academic performance (e.g., Meyer and Bendig, 1961). While highly useful in the prediction of performance in these areas, the meaning of IQ in such cases should be interpreted with care. Too often, evidence of this sort is cited as a potent argument for the impact of IQ on achievement in academic subjects. This interpretation is short-sighted. The observed relationships may be spuriously high due to the fundamental similarities in the items on the intelligence test and those contained in the end-of-term examinations used by Day. At the core of most tests of overall intelligence two primary abilities are represented, one verbal, the other quantitative. Note that the high relationships between IQ and end-of-term examinations were obtained in those academic areas where one would expect either one or the other factor to be prominent.

One might be able to state without too much contradiction, that these academic performance exams are little more than parallel, non-standardized forms of the IQ test (McClelland, 1973). Additionally, while IQ is demonstrated to be a significant factor in achievement, it at best accounts for approximately 40 per cent of the variation in exam scores, leaving approximately 60 per cent of the variance unaccounted for.

The advent of the 1950's signalled a decrement in the psychometrician's prominence in the study of adolescent cognitive functioning, with a significant historical shift in the emphasis of developmental studies. American psychologists were slowly but progressively exposed to the voluminous work of J. Piaget, whose earlier translated essays on developmental stages were met with skepticism, disinterest, and patent disregard. Offering a basic developmental theory of the development of thought through adulthood well buttressed by logic and extensive empirical investigation, Piaget changed the shape of psychological research in adolescent cognitive functioning. Adolescence was described as the beginning of the final stage of cognitive development, when the earlier experiences of the child with his world, his transactions with the environment culminated in the magnificent human accomplishment of being able to reflect on his thought, as well as formulate abstractions and hypotheticalities without the need for concrete struts.

Students of development embraced Piaget's observations and extensively elaborated his work with research anchored in the acceptance of formal operational thought as premise of the uniquely adolescent development.

A virtual cornucopia of testable hypotheses was lodged in this premise, freeing the researcher from the rigour and precision of study characterizing the work of the psychometrician in pursuit of his goal, and making the study of developmental change a dynamic and exciting area. Rather than attempting to ascertain how much the adolescent knows, or how many different ways can he manipulate test materials, essentially quantitative features of cognition, Piagetian research and theory is addressed to evaluation of how the adolescent perceives and manipulates his world, a fundamentally qualitative question. How does he think about and manipulate the relationships observed between different elements in his environment? Does the environment seem to have any meaningful order or structure to it? Does he appreciate the consequences of his actions on the environment? Does he appreciate the historical past and the probability of a future in a meaningful way? Is he responsive to information which threatens a view of reality which is personal? Those are representative issues which consume the work of Piaget and the cognitive-developmentalist studying adolescence.

iii. Implications of Piagetian Theory

Implications for education of Piaget's position on the development of thought during adolescence are multiple, though indirect. Acceptance of the validity of Piaget's theory and research dictates a reevaluation of teaching methods and modification of programs to accommodate the emergent cognitive developments of adolescence.

Remarkable discontinuities in the qualitative dimensions of thought are cited when middle years school children are compared to early adolescents. The adolescent is more proficient at abstraction and utilization of general principles without need for concrete referents; he develops a sense of time and historical perspective, can engage in flights of fancy as well as controlled deductive thought, separates personal viewpoint from external reality, and is responsive to the challenge of that reality when it violates personal hypotheses. These characteristics of adolescent cognitive functioning must be reflected in educational methods in order to maximize their efficiency as well as afford the adolescent the optimal environment for further development.

One major difficulty restricting the incorporation of Piagetian theory and research into educational approaches is the absence of a convenient measure or measures of these qualitative cognitive transformations in thought during adolescence. It is at this juncture that one may see a convergence of the psychometric and Piagetian view of intellectual functioning. While work is underway to rectify this situation, its successes have been limited. Hopefully, the future will provide an economical and useful means of determining the emergence of qualitative capabilities, for its practicality would be invaluable. If the educator knew that the adolescent had mastered abstraction of concepts in a given area of tutelage, then he could organize his presentation of further materials by reducing the number of concrete references. The teaching of history, as another example, would be facilitated if there were some psychometric evidence that concepts of time had matured.

Closely allied to the efforts of Piaget to trace the development of thought is the work of Vygotsky (1962), which is more clearly a theory of education and stresses the relationship between thought and language. This theory and accompanying research will be examined in its rudimentary form, since its implications for adolescent cognitive functioning is equally broad, though it attempts to apprehend more than solely adolescence.

Another major thrust of research in adolescent cognitive functioning hinges on the current and energetic study of cognitive styles, differences in the manner used to receive, process, and utilize information. There are substantial indications that cognitive style is independent of intelligence and seemingly has little to do with qualitative transformations in thought accompanying adolescence. Students of cognitive style would recommend that two children who are equivalent in IQ and having reached a stage of development where higher-level abstraction is no problem, still would demonstrate profound differences in their respective approaches to problem solving. Where one adolescent may be impulsive and quick in his reaction to the elements of a problem, making a decision on the surface information which he perceives, another is reflective and coldly analytic in evaluating all possible alternatives and outcomes. In another case, one adolescent may be responsive to the entire context of the problem, unable to differentiate the features central to its solution and allowing the problem to overcome him, while another adolescent is capable of extracting the most important features from their noisy and complex background. The dimensions of cognitive styles are multiple and varied. Two dimensions will be reviewed in the present document: field independence - field dependence and reflectivity-impulsivity.

Their review is contingent on the recognition that the adolescent's style of interaction with the environment modifies and affects the cognitive information he assimilates. This mediational process must of necessity leave a distinct cognitive trace and differentially contribute to intellectual development.

Identification and elaboration of the individual adolescent's style in information-processing and synthesis should be considered as valuable data for modification of curricula. It may be that a particular method of presentation of educational materials may be more efficient with children exhibiting one cognitive style as opposed to another. Perhaps the modification of the adolescent's customary style in information processing can be accomplished to assist him in the assimilation of one form of material as opposed to another. We do know that certain kinds of contents are best handled by particular cognitive modes. For example, scientific and mathematical concepts are most effectively understood by an adolescent who is reflective and analytic in his study and use of the relevant educational materials, while the impulsive and globally reactive adolescent seems more capable and efficient in treating humanities, artistic and literary materials.

7. The Need for Curriculum Reform Based on Knowledge of Adolescence

Twentieth century North American educators have not been oblivious to the need for change and curriculum reform in the education of adolescent youth. For the past sixty years there has been a considerable amount of interest and effort invested in the question of the best grade organization for adolescent education (Myers, 1970). The reasons underlying these organizational changes were not always for the best reasons and most were patently unrelated to the real question in curriculum reform: the cultivation of the individual and the assurance of a self-renewing society.

According to Goodlad these efforts at reform have been largely the product of pressures for societal preservation. A case in point: the development of junior high school in the 6-3-3 plan of organization was largely predicated on an effort to provide secondary education at an early age, to keep students in school longer or to bridge the gap between the self-contained elementary classroom and the highly specialized program of the senior high school (Read, 1969). Only a weak reference was ever made in the innovation of the junior high school to the most fundamental issue of curriculum reform. Goodlad (1964) characterizes the most current curriculum reform as a refurbishment of "shockingly outworn courses" whose objectives stressed the importance of understanding the structure of the discipline, the purposes and methods of the field and the part that creative men and women played in developing the field. Goodlad looks forward to the day when

> ...the curriculum will be planned from the bottom up, with knowledge of students and their achievements built into the sequence of subject matter in the curriculum design. This movement will be marked by experimentation and by the emergence of curriculum alternatives far exceeding the number of alternatives that have emerged so far through the current curriculum projects (Goodlad, 1964).

The curriculum of the future as envisioned by Goodlad will have as its core a built-in flexibility that adapts the school program to the unique needs of the individual and a self-renewing society:

> ...the school must provide the institutional and organizational resources to meet the large proportion of youth's needs. But most of all it must also provide the small flexible organizational units in which the individual's needs are observable, where he manifestly matters, where the tasks are large enough to be a challenge yet small enough to give importance to his energies, where problems are within his direct experience and comprehension, where he lives with others who share his heritage or who come from quite different backgrounds.
>
> The concepts of teaching the whole child, of teaching subject matter, of preparing students for life, of having students participate in life's daily activities, of teaching through solving problems, through learning abstract ideas are not concepts to be pitted one against the other. They are a part of a Gestalt in which each plays a significant role at certain times but interacts constantly with the others in the maturity and development of the individual (Goodlad, 1964).

2 Growth and other Physiological Levels and Events in Adolescents

1. Introduction

Adolescent physiology is nothing more than a subset of human physiology. Physiology as such is concerned with the physical mechanics of organismic function, and thus includes the functioning of both the parts of the organism, and the organism as a totality. Properly speaking, psychology, or human behaviour, can be considered to be a part of human physiology. This is so for two reasons: first, human behaviour is the sum total of the overall activity of the human organism; second, the behaviour of the organism will be constrained by the physical limitations of the human organism. It is a truism in physiological psychology that one cannot teach (or, one cannot condition) a rat to fly no matter how hard or long one tries. This is simply so because rats are aerodynamically unstable--they do not possess the physical attributes in terms of shape and propulsion to act as heavier-than-air flying machines. The same sort of constraints apply to the human organism. One of the goals of adolescent physiology is to establish what adolescents are capable of; another is to establish what adolescents are not capable of.

There is one difficulty inherent in the study of adolescent physiology which is not present in the study of childhood (preadolescent) physiology, and is also not present in the study of adult physiology. Except for the period of intra-uterine life, no period other than adolescence in the human life history is associated with very rapid changes in physiological parameters. In the preadolescent period,many physiological parameters show a decline in their rates, or velocities, relative to foetal life or infancy. At adolescence, these rates (for example, rate of increase in height, rate of increase in mass) show rapid increases, and just as rapid subsequent declines. Further confounding the research of those who study the physiology of adolescence is that the increases and decreases of rates of various parts of the human organism do not necessarily increase and decrease at the same time or at the same velocity. The rate of one function may be increasing while the rate of another function may be decreasing. Changes in time or rates of functions may be causally related to sex, chronological age, physiological age, nutritional background, sociological parameters, general genetic background, and so forth. Further, the rate of change may also change with time, necessitating overlapping longitudinal studies of adolescents, such studies preferably beginning before adolescent development and continuing for some time after adolescence. Because of this constant flux, change, and changes in change; because of the relative ease of investigating some physiological parameters and the relative difficulty of investigating other phenomena, adolescent physiology is at present in a state such that there are large gaps in the field of knowledge called adolescent physiology. Most troubling of all perhaps is the lack of baseline data, against which other data might be compared to ascertain normality or lack of it. Associated with all of the changes mentioned above is the inherent variability found among the individuals which constitute any biological population.

It will be worthwhile to establish the human population, and its subset, the adolescent population, within the framework of biological operations on this planet. The hypothesis most commonly (rightly or wrongly) held by most biologists is that life arose spontaneously on this planet; that is, there was established a molecular aggregate that possessed at least the following attributes: 1) this aggregate was capable of controlling within certain limits its own internal operations, 2) this aggregate was capable of producing other aggregates similar to but not identical with itself, that is, it and its descendants were capable of reproducing; 3) these molecular aggregates and their descendants were capable of varying their life style as their environment changed. This ability is a function of all the entities of a population, and is a horizontal function that extends through generations of biological entities. As a function of populations, this ability is aimed at group survival with change, rather than group extinction with no change. The populations change blindly and unknowingly to become more efficient, in the physicist's sense, as the environment changes. This overall capability is more formally called Darwinian evolution. Finally, biological entities are capable of altering their surroundings or environment.

In the course of animal evolution on this planet, there is evidence that approximately thirty distinct life-styles have so far appeared as the result of Darwinian evolution (Russell-Hunter, 1968). The biologist refers to each of these particular life-styles (and the individual members who constitute it) as a phylum. Each phylum can be characterized by certain anatomical and functional (= physiological) features. Basically each phylum or life-style is more or less successful; success can be measured by the total bio-mass constituing that life-style, and by the total number of variations (= species) on the theme of that life-style. Success measured in these terms is quite simply a measure of the physical efficiency of each life-style. Efficiency here is a measure of the amount of energy which must be expended to obtain the necessary energy and raw molecular material to survive as functional biological entities. The more energy and raw material left over after deductions for maintenance, the more energy and raw materials left over for producing new individuals (increase in bio-mass), and the more energy and raw materials left over for experiments in variation (increase in species). The chordate phylum, of which the human species is one of approximately 45,000 species, or variants, is a moderately successful group, but much less so than such phyla as the nemathelminthes (free living and parasitic round worms), the molluscs (snails, clams, squid), or the arthropods (insects, spiders, crabs, etc.). The basic chordate system revolves around an efficient musculo-skeletal system, a highly adaptable and plastic nervous system, and a digestive system very well adapted to obtaining and processing food stuffs. In association with this basic pattern, the human species, along with many other chordates, has added the following, among others: an efficient internal transport or circulatory system for maintaining the proper internal molecular milieu, a constant body temperature which maintains a high rate of cellular efficiency, limb development so important for manipulating and changing the individual's immediate and long-term environment, and a form of sexual reproduction in which the individual produces few but highly protected and educated offspring over the short haul, but such reproduction allows the population to produce more than adequate offspring over the long haul to allow for species survival and species evolution. More proper to humans is a complex nervous system (which differs more in degree than kind relative to other closely-related chordate species). In humans, this nervous system is capable of a relatively high degree of abstract activity, and is also capable, in association with muscular structures not at all peculiar to humans, of producing the highly variant and plastic form of human behaviour called speech. Perhaps the only human activity peculiar to humans is the ability to produce more human beings.

Physiology then sets out to study the mechanical operations of living things, in this particular instance, a period of life of human organisms known as adolescence. Adolescence is a period in human life history in which the human organism changes over from a larval condition to an adult condition. The larval condition of any biological entity is characterized by two operational states, one present and one lacking; viz.,larval organisms possess the ability to maintain themselves, however, they lack the ability to reproduce. The period of childhood (from infancy to the beginning of adolescence) is the period during which the larval potentiality becomes actualized. The period of adolescence involves the conversion of the self-maintaining human being into the self-maintaining and reproducing human being. Without the reproductive capability, of course, the human species would be doomed to extinction. This is so, of course, for all biological entities.

2. Growth in Adolescents

i. Patterns of Growth in Height and Weight

The most studied growth parameters in children and adolescents (probably because of the ease of obtaining data) are growth in height and growth in mass. Tanner (1961, and elsewhere) reports on the oldest known study of growth of a child, that made by Count Philibert de Montbeillard upon his son during the years 1759 to 1777. This time period covers the time from the child's birth through 18 years. If one plots height against age, the resulting curve is non-linear and appears at first glance, to be smoothly parabolic, asymptotically approaching adult height. However, if one plots height gain relative to previous time period against age, it can be seen that the attaining of adult height passes through four separate stages; 1) initially the height gain per year, say, decreases very rapidly for the first 3 to 5 years of life. For example, a child gains much less in height between age 2 and 3 than it gained in height between age 1 and 2. 2) There follow several years of very slowly decreasing annual or periodic increases in height. 3) This period of relatively stable incremental increase is followed by a short (3 to 4 year) period during which increase in height accelerates; that is, the annual or periodic increment in height increases relative to the previous time period. This time period is called the adolescent growth spurt; at no time does the height increment reach the height increments attained during the first year of life. 4) The adolescent growth spurt, of 3 to 4 years duration, is followed by an equally abrupt and perhaps slightly more rapid decrease in the annual or periodic increase in height. The annual increment decreases to zero as adult stature is achieved.

Such graphic plots, in which annual or periodic increments are plotted against age, are referred to as velocity or rate of growth curves. The general pattern of velocity curves are a human universal as can be seen by studies made in Bulgaria (Anguelou, et al., 1971), Iran (Wadsworth and Emani, 1970), China (Chan, 1972), France (Roy, et al., 1972), Burma (Khin, 1971), England (Marubini, et al., 1972), and Nigeria (Johnson, 1970). The advantages of the velocity curve for studying the adolescent growth spurt are that 1) for individual cases, the initiation of the growth spurt can be fairly easily recognized. 2) The rapid growth spurt followed by an equally rapid deceleration in growth produces a sharp peak on the velocity curve. This value is the peak height velocity (=PHV)1 because of its sharpness, the age at which it occurs can be very readily ascertained. Peak height velocity ages can be lumped together and treated statistically for comparative purposes, and also for the purpose of attempting to relate other adolescent growth (in sensu latu) events. The relationships thus established may then turn out to be causally related.

Differences in peak height velocity are sex-related. On the average, peak height velocity is reached in girls about 2 years before peak height velocity is reached in boys. The range over which peak height velocity is achieved for girls is ages 10½ to 13 years, for boys from 12½ to 15 years. The intensity of growth is such that at peak height velocity, the average increment for boys is about 4 inches a year; and for girls, somewhat less. Before puberty, boys average only 1 to 3 per cent taller than girls; the earlier average adolescent growth spurt of girls relative to boys results in girls being taller than boys on the average from ages 10½ through 13. The later greater and perhaps longer sustained adolescent growth spurts of boys result in their eventually reaching the same height as girls, then passing them in height so that on the average boys average some 10 per cent larger in height and most other dimensions (Shuttleworth, 1939).

While practically all skeletal and muscular dimensions take part in the adolescent growth spurt, all parts do not necessarily undergo the same relative amount of change at the same time. There is a rather regular order of growth timing. Generally, leg length reaches its peak growth velocity first. This is followed by an increase in body breadth with shoulders last, such increase beginning a few months after leg peak height velocity is achieved. Most of the spurt in adolescent height is due to increase in trunk height, whose peak growth velocity does not occur until about a year after leg peak growth velocity (Tanner, 1972). Generally growth in lower limb length is quick and short, occurring in early adolescence. Growth in trunk length is slow and prolonged (Chan, 1972).

Subcutaneous (or underskin) fat which has a temperature-insulative function and also an energy storage function also has a function in determining the contours of human individuals. The qualitative or descriptive terms "leanness" and "plumpness" are expressions of the amount of subcutaneous fat a person possesses. The more rounded contours of women relative to the contours of men are expressions of the average difference in subcutaneous fat between the two sexes. Subcutaneous fat can be measured by X-ray or more simply by picking up a fold of skin and fat, and measuring the skin-fold thickness with a special skin-fold calliper. Skin-fold measures have been taken at the back of the upper arm, just below the bottom of the shoulder blade, at the side of the neck, and on the abdomen below the umbilicus in various studies. Subcutaneous fat thickness increases dramatically after birth to about nine months, declines slowly and steadily until ages 6 to 8, depending upon the individual child. Beyond this time, subcutaneous fat levels increase again; in girls both trunk and limb subcutaneous fat increase up to maturity. On the other hand, in boys, subscapular (body) fat increases until maturity while limb subcutaneous fat increases until about the time of the adolescent growth spurt, and then decreases (Tanner, 1961).

Since increase in limb length precedes increase in trunk length and breadth, since the length of the extremities (hands and feet) increases with limb length, and since the quantity of subscapular fat is generally quite low (but increasing) at the earliest stages of adolescence, early adolescents may become very self-conscious about their apparent disproportionate body parts. A preadolescent curriculum which would include some study of what to expect during their growth spurts may help alleviate these self-conscious attitudes.

As Tanner (1961) points out, weight curves as a function of age are less informative than height curves in establishing time of adolescent growth spurt. Under certain clinical and/or pathological conditions, growth in height may cease while growth in weight does not. This increase in weight would be primarily due to increase in subcutaneous fat. Tanner urges that regular measurements of height and weight in schools be supplemented by measurements of subcutaneous fat of skin-folds, and by measurements of the circumference of the upper arm. This last measurement, after subtraction of subcutaneous fat, will yield a value for the increase in mass of bone and muscle; this value follows the general height curve.

ii. Sexual Maturation in Adolescents

The primary end result of sexual maturation in the human species is the acquisition by the gonads of the ability to produce functional sperm (the process of spermiogenesis) in the case of the male testes, or the ability of the ovary in the female to shed eggs into the body cavity. The process of spermiogenesis in the human male (as in most mammals) is a continuous process. The testes consist of a mass of coiled tubes, the cellular walls of which constantly produce new spermatozoa in the same stage of maturation; consequently there is a continuous production of functional spermatozoa. Oogenesis in the human female is essentially complete before birth. As in most mammals, all the eggs (ova) which a particular human female will possess have been present in the ovary since before birth (Balinsky, 1970, and others). The primary result of sexual maturity in the human female then is maturation of the ovarian tissue so that the already mature ova can be released. The rate of release of ova is approximately one ovum per month.

Associated with the primary sexual characteristics listed previously is the development and maturation of the secondary sexual characteristics. The secondary sexual characteristics are concerned with the following items: 1) delivery of eggs and sperm to a mutually benign environment so that fertilization of the ovum can occur (in humans the upper third of the oviduct), 2) providing a suitable prenatal environment for the embryo, 3) providing a source of postnatal nourishment for the infant, and 4) providing sexual recognition devices so that an individual can distinguish between same-sex and other-sex individuals.

Studies of the acquisition of primary sexual function are sparse; ovarian function can be discerned by ovarian examination from autopsy material, or by X-ray examination of the ovary. Accidents are the major cause of death among adolescents. Autopsy material may have already begun to deteriorate by the time permission to examine has been obtained; there may be difficulty in reconstructing a valid medical history. Ovarian X-rays examinations are usually done only when pathological conditions are suspected. Potential genetic damage by X-ray radiation to the already-functional ova in the preadolescent or adolescent rules out routine screeing of ovarian function. Likewise, most preadolescent and adolescent boys would object to testicular biopsy (removal of small amounts of testicular tissue by needle puncture) on a routine basis. Consequently, sexual maturation has generally been discussed or related to changes in secondary sexual characteristics.

These characteristics are more accessible to general study.

Tables of sex maturity stages based on secondary sexual characteristics have been established for adolescent boys and girls. These tables began with a study by Greulich, et al. (1939), in which a rating system for the development of the human breast was established. They were extended by Reynolds and Wines (1948, 1951), further elaborated, including photographs of the developmental stages of adolescence, by Tanner (1962) and reprinted by Gallagher (1960). Tables II and III present descriptions of the Tanner sexual maturity stages for boys and girls.

The Tanner system provides a quick and easy method of establishing the levels of physical maturation achieved by individuals. Apparently little training is required to learn to use the system; its universal adoption by pediatricians and other medical personnel who deal with adolescents has been urged. In a review article on some of the clinical and physiological aspects of puberty, Visser (1973) presents a set of tables of the mean ages for boys and girls at which different stages of pubertal development are reached (see Table IV). Along with the Tanner stages of breast and pubic hair development are presented data on the average age of menarche. Note that these data are compiled from individual cross-sectional studies from various sources; the advantages of those tables are that they allow cross-comparisons among various cultures; and at the same time, since the studies were done over a period of 22 years, they can be used as indicators of trend changes in pubertal development.

Table II. Sex Maturity Stages in Girls

Tanner Stage	Pubic Hair	Breast Development
1	Preadolescent. The vellus (or down hair) is not any different or more developed on the pubes than it is on the abdominal wall.	Preadolescent. Only the papilla (nipple) is elevated above the general chest surface.
2	Sparse, lightly pigmented, generally straight or slightly curled; along the medial border of the labia.	Breast and nipple elevated as a small mound. The diameter of the areola (darker pigmented area surrounding nipple) has increased over preadolescent stage.
3	Hair is darker, coarser and more curled than stage 2. Increased area is covered.	Breast and nipple areola enlarge. There is no contour separation between breast and areola.
4	Hair is of the adult type; i.e., coarse, curly, abundant. No spread to medial surface of thighs.	Areola and nipple form a secondary mound.
5	Adult feminine triangle; spread to medial surface of thighs.	Mature breast; nipple projects above general breast contour. Areola is again part of general breast contour.

Table III. Sex Maturity Stages in Boys

Tanner Stage	Pubic Hair	Penis	Testes
1	None; no difference between pubic hair and abdominal hair.	About same size and shape as in early childhood. Preadolescent pattern.	
2	Sparse growth of long slightly pigmented downy hair, straight or slightly curled, chiefly at base of penis.	Very slight, if any, enlargement.	Enlarged;skin over testes is pinkish; texture has altered.
3	Darker than above, but still sparse, curling apparent.	Penis has elongated; perhaps thickened slightly.	Testes and scrotum enlarged over stage 2.
4	Hair is adult type, but has not yet spread to medial surface of thighs.	Glans and breadth of penis have increased in size.	Scrotal skin has become dark-pigmented.
5	Adult type; present on medial surface of thighs.	Adult in size and shape.	Adult in size and shape.

Table IV. Average Ages at Which Different Tanner Stages of Pubertal Development are Reached by Boys and Girls.*

GIRLS	B_2	B_3	B_4	B_5	PH_2	PH_3	PH_4	PH_5	Menarche	Country
Marshall and Tanner (1969)	11.2	12.2	13.1	15.3	11.7	12.4	13.0	14.4	13.5	England
Van Wieringen, et al. (1968)	11.0	12.1	13.4	15.2	11.3	12.2	13.3	14.9	13.4	Netherlands
Nicolson and Hanley (1953)	10.6	11.2	--	13.9	11.6	12.5	13.2	--	12.8	U.S.A.
Reynolds and Wines (1948)	10.8	11.4	12.2	13.7	11.0	11.9	12.5	13.9	12.9	U.S.A.

BOYS	G_2	G_3	G_4	G_5	PH_2	PH_3	PH_4	PH_5	
Marshall and Tanner (1970)	11.6	12.9	13.8	14.9	13.4	13.9	14.4	15.1	England
Van Wieringen, et al. (1968)	11.0	13.2	14.2	15.9	11.8	13.5	14.4	16.0	Netherlands
Nicolson and Hanley (1953)	11.8	13.1	13.8	15.2	--	--	--	--	U.S.A.
Reynolds and Wines (1948)	11.5	12.7	13.4	17.3	12.2	13.3	13.9	16.1	U.S.A.

* Letter-number symbols are abbreviations for Tanner developmental stages (Breast, B_2--G_5; Pubic Hair, PH_2--PH_5). From Visser (1973).

In the same paper, Visser recalls that puberty had been defined as the process of the maturation of the sexually immature child into the sexually mature adolescent, while adolescence is the period of human development when secondary sexual characteristics have appeared completely but full maturity has not been reached. Visser feels that these two terms have become blurred, and at the present time the terms are used interchangeably.

Young (1972) has presented a rather more complex set of tables for determining levels of sexual maturity in boys and girls. Young's classification of sexual maturity in girls is as follows:

	Classification	Characteristics
1	No change from a child	No growth of pubertal hair; no growth spurt.
2	Prepubertal phase	Downy pubic hair; usually first evidence of growth spurt; elevation of the breast papilla; perhaps breast budding.
3	First stage puberty	Pubic hair; pigmented, coarse, and curly in small quantity; budding of breast, areola enlargement; marked growth spurt; enlargement of labia.
4	Second stage puberty	Pubic hair as described above in moderate amount, filling out of breasts; sometimes projection of areola and papilla to form a secondary mound; axillary hair in small quantity; menarche usual in this phase; growth spurt marked but decreasing, further enlargement of labia.

	Classification	Characteristics
5	Third stage puberty	Pubic hair further increased and approaching adult quantity and distribution; moderate quantity axillary hair; breasts reaching adult type configuration with recession of areola to level of the breast; labia reaching adult type. Annual growth less than before puberty; menstruation usually well established.
6	Adult	Further growth axillary and perhaps pubic hair to adult type and distribution; breasts adult, labia, adult; growth in height usually less than 1.5 cm in previous 12 months.

The criteria for physical maturation in boys are the following: 1) testicular volume, on a scale of 1 - 6; obtained by comparison with plastic models obtainable from Sandoz Chemical; 2) pubic hair rating on a scale of 0 - 4 (see below); 3) axillary hair rating on a scale of 0 - 4 (see below):

The standards for pubic hair are as follows:

0 - no visible hair

1 - downy, usually unpigmented, fine, straight hair

2 - pigmented, coarse, crinkled hair in small amount

3 - pigmented, coarse, curly or crinkled hair in considerable amount.

The same standards for axillary hair apply except that stage 1 consists of fine straight hair in small amounts. Young states that this stage is rarely seen.

As Young has a table of sexual maturity in females, he also has a sex point scale of sexual maturity in males:

Stage	Characteristics
1	Childlike, testicular volume 1; generally no development of secondary characteristics.
2	Prepubertal; testicular volume 2, pubic hair 1, axillary and body hair 0. There is a slight increase in penile length and diameter, in the eyebrows, and in the length of the cheek line.
3	Puberty, first stage; testicular volume 3 - 4, pubic hair 2, no axillary hair, definite enlargement of penis, evident growth spurt.
4	Puberty, second stage; testicular volume 4, pubic hair 3, axillary hair 2, moderate enlargement of penis, evident growth spurt.
5	Puberty, third stage; testicular volume 5, pubic hair 3 - 4, axillary hair 2 - 3, further enlargement of penis; growth spurt tailing off rapidly such that annual increment usually less than puberty.
6	Adult form; testicular volume 6, pubic hair 4, axillary hair 3 - 4; not more than 1.5 cm growth in body height in previous 12 months.

Young states that the following equation--

(0.5) (pubic hair rating) - (0.4) (testicular volume) - (0.3) (axillary hair rating) - 0.5 = pubertal age on 6 point scale--

yields a quick and precise measurement of pubertal maturity in boys.

iii. Physiological Age, Chronological Age, and Sexual Maturation

Chronological age is a poor indicator of adolescence. This can be shown by examining data on the average chronological age of any adolescent events, especially when these data include standard deviations of measurement, or the range of ages during which a particular event occurs. Tanner (1970, 1972) in studies involving thousands of children observed that the chronological age range over which menarche occurs is ten through sixteen and one-half. The height spurt may begin as early as age nine and one-half and may begin as late as age fourteen and one-half; breast bud stage may be as early as age eight and as late as age thireen; pubic hair may reach stage 2 as early as age eight in some girls, and as late as age fourteen in others. Similar ranges are found for developmental patterns in boys. Initiation of height spurt may begin as early as age ten and one-half or as late as age sixteen. Cessation of the growth spurt may be as early as age thirteen and as late as age seventeen. Penis development may begin as early as age eleven or as late as age fourteen and one-half, and may be completed as early as age thirteen and one-half and as late as age eighteen. Ten-year-old boys may show signs of pubic hair development; it may be delayed as late as age fourteen. In some boys, the adult pubic hair pattern (pubic hair stage 5) may be achieved as early as age fourteen or as late as age eighteen. Increase in testicular volume may begin as early as age ten and be complete as early as age fourteen and one-half. In other boys, testicular volume increase may not become apparent until age thirteen and one-half, nor be completed until age eighteen. These differences are graphically illustrated by Tanner (1969) in a series of photographs involving three girls aged precisely 12.75 years, and three boys aged precisely 14.75 years. A cursory examination of the photographs reveals that the maturational ages represented by these six photographs range from preadolescent (prepubertal) through adult.

To reduce the dependency upon chronological age, various physiological standards have been employed to establish developmental ages. These standards are particularly valuable in studying growth and related maturational events in adolescents, as they are based on physiological events through which all adolescents will pass, sooner or later. While such criteria as the number of erupted teeth, and the per cent of water in muscle cells have been used, the most useful criterion so far established is that of bone age or skeletal maturity, and as such is a measure of how far any particular bone has progressed toward reaching its final or mature shape and relative positioning to other skeletal elements. Each bone in the human body begins as a primary centre of ossification; it passes through definite stages of enlargement and shaping. It may develop secondary centres of ossification (epiphyses) which finally fuse with the primary centre (diaphysis) to form the adult bone. All of these developmental stages can be easily visualized by X-ray, and permanent records can be readily made and maintained for comparative purposes. Standards are available for the left hand and wrist (Greulich and Pyle, 1959; Acheson, 1966; and Tanner, Whitehouse, and Healy, 1962), the pelvis, the knee, and the ankle. The left hand and wrist standards are most commonly used. In the Greulich-Pyle standards, there are separate plates for boys and girls representing standard ages 5.0; 6.0 and so on. X-rays of children are compared to the standard ages in the Greulich-Pyle atlas, with interpolations between standards being allowed if necessary. The Acheson method involves mathematically scoring each individual. This score is then compared with the range of scores of a standard group, and a percentile value is assigned to it. The Tanner-Whitehouse-Healy system likewise involves a scoring technique and a percentile rating applied to the final score. The value of these skeletal maturity systems is well-established; but they do suffer from the fact that the data are from cross-sectional studies involving children from very small locales. Tanner's standards were derived from a large sample of Scottish urban and rural children who were on the average six to nine months behind their North American middle-class counterparts who formed the basis of the Greulich-Pyle atlas. Also, Greulich and Pyle's atlas is at present 15 years old. Acheson's, the most recent, is eight years old. If there are secular trends (see below) in maturation, then these studies/standards may well be obsolete or at least obsolescent. For those who are interested in the maturational level of adolescents, local and contemporary standards of skeletal maturity should be generated and supplied.

As an example of the value of skeletal maturity and the concept of physiological age as opposed to chronological age, Tanner (1970) points out that the chronological age range over which menarche may fall is from 10 to 16½ years; the skeletal age range for the same event is only 12 to 14½ years. Other correlations have been established using skeletal age and chronological age at menarche and have a correlation of 0.85 at menarche, and 0.55 at age 6. It has been established that early-menarche girls have consistently advanced skeletal ages over late-menarche girls from at least chronological age 8 on. Conversely, the skeletal age at which menarche occurs increases as one goes from early through middle, to late-menarche girls, thus indicating a relationship between the tempo of skeletal age and the maturation process. Early menarcheal girls were those in whom menarche occurred between the chronological ages of 10 and 12; middle-menarche girls experienced menarche at ages 12 to 13; and late-menarche girls first menstruated at ages thirteen through fifteen and one-half. Longitudinal studies (i.e., studies of the same individuals over several years) of skeletal age would have some value as a predictor of developmental events for those groups who may be interested in such data. Against the need-to-know such data must be at the expense of maintaining such an operation, and also the problem of exposing small children and adolescents (especially girls) to the small but measurable amounts of radiation to obtain the hand X-rays.

iv. The Relationship Between Sexual Maturation and Other Physiological Parameters

As has been stated above, there has been observed a relationship between skeletal maturity and sexual maturity as evidenced by menarcheal age. In general, the faster the rate of skeletal maturity the earlier is the skeletal age at which menarche occurs. This observation has been confirmed by Bergmann and Koniaced (1971) on 310 Polish girls aged 10 to 16. In this longitudinal study, the metacarpals were examined for presence or absence of pseudoepiphyses associated with the metacarpal bones (those between the wrist and the fingers) of the left hand. In that group in which pseudoepiphyses were lacking, menarche occurred significantly earlier than it did in the group in which pseudoepiphyses were present. Even at age sixteen, those lacking pseudoepiphyses were 0.7 years ahead in average menarcheal age than their pseudoepiphyseal-possessing counterparts, indicating that late maturers tend to be slow maturers.

Shuttleworth (1939), and Kantero and Widholm (1971) have observed a relationship between early "size", age at menarche, and adult "size". These results have been confirmed by Miller, et al. (1971). In general, early-menarche girls are taller and heavier at age nine than their late-menarche counterparts. For example, average weight at this age for girls who experienced menarche before 12 years of age was 27.2 kg (approximately 60 pounds), and for girls who experienced menarche after 15 years of age was 25.8 kg (approximately 57 3/4 pounds). Heights for the respective groups at age 9 were 128.5 cm (approximately 51 inches). Curiously, while the weight advantage remains in favour of earlier-maturing girls at age 22 (59.8 kg or 131 pounds vs.,47 kg)or 104 pounds for late-maturing girls, the height advantage switches so that later-maturing girls on the average at age

22 are taller than their earlier-maturing counterparts (162.0 cm or 63 + inches vs.157.4 cm or slightly less than 62 inches). They suggested that rapid growth may lead to earlier maturation and attainment of adult size.

These results have been confirmed by Anguelov (1968) for Bulgarian adolescents; he emphasized that an early puberty correlates with a final height inferior to the average and vice-versa; and by Wadsworth and Emani (1970) for urban Iranian girls. Frisch and Revelle (1969, 1970, 1971) conducted computerized longitudinal growth studies in which determination of the following were made: 1) age of initiation of adolescent height spurt, 2) age of initiation of the adolescent weight spurt, 3) the height attained at the age of initiation of the height spurt, and 4) the weight attained at the age of initiation of the weight spurt. For girls, the average age of initiation of height spurt was 9.6 ± 0.1 years; the average height at initiation of the height spurt was 136.5 ± 0.84 cm (54 ± 0.32 inches). This corresponded to 82.5 per cent of the height at age 18. As the age at which the initiation of the height spurt increased, the height at time of initiation of the height spurt also increased, e.g.; the average height at initiation of the height spurt when the age at initiation averaged 7.9 years was 125.7 ± 2.3 cm (49.5 ± 0.89 inches); the average height at initiation of the height spurt when the age at initiation was 11.1 years was 141.1 ± 1.0 cm (55.5 ± 0.39 inches);the average age at initiation of the weight spurt was 9.5 ± 0.1 years;

the average weight at initiation of the adolescent weight spurt was 30.6 ± 0.30 kg (67.4 ± 0.66 pounds). This value respresented 53 per cent of the mean weight of the children in this study at age 18. These co-workers found no significant change of the average weight at age of initiation of the adolescent weight spurt as the age of initiation increased, or as the average menarche age increased. The average time to menarche was 3.2 ± 0.07 years from the age of initiation of the adolescent height spurt, and 3.3 ± 0.07 years from initiation of the adolescent weight spurt.

For boys, the average age at initiation of the adolescent height spurt was 11.7 ± 0.09 years; the average height at initiation of the adolescent height spurt was 147.3 ± 0.47 cm (58.0 ± 0.18 inches). This value represents, on the average, 82 per cent of the average height reached at age 18. The average height at initiation of the adolescent height spurt was found to increase with increasing average age at initiation of the adolescent height spurt. The average age at initiation of adolescent weight spurt for the boys in this study was 11.6 ± 0.09 years. The average weight at initiation of the adolescent weight spurt was 36.9 ± kg (80.5 ± 0.73 pounds). This value represented 54.1 per cent of the average weight achieved by the boys in this study at age 18. Frisch and Revelle found a slight, but significant, increase in average weight at the initiation of the adolescent weight spurt as the age at which the adolescent growth spurt increased. Height and weight spurts in girls began on the average one year before the appearance or the development of the secondary sexual characteristics, i.e.,breast development and/or pubic hair development.

These results have led Frisch and Revelle to hypothesize that for any individual, achievement of a critical weight causes a change to a critical metabolic level at which there is an increased endocrine activity (specifically, they propose an increased output of either adreno-corticotropic hormone, or ACTH; and/or an increased output of somatotropin, or growth hormone); and that this increased hormone activity is the cause of the adolescent growth spurt. As inferential evidence offered in proof, they suggest that the secular trend to an earlier menarche can be explained by the critical weight-adolescent event hypothesis; that is, that the cause of the well-documented trend (see below) toward an average earlier date for menarche has been caused by the relative abundance of food stuffs, the result of which is that as more girls gain weight faster, the age for the onset of menarche has, on the average, dropped. What Frisch and Revelle do not say is equally important. There is a certain vagueness in the terms "critical weight" and "critical metabolic level". They do not suggest that there is an absolute critical weight at which all girls (and by inference, all boys) will begin their adolescent growth spurts; to do so would be to deny the genetic variability found in the human species, not to say the environmental variability to which the population in their studies were subject. Further, they have no evidence concerning "critical metabolic level". Metabolism is a measure of the sum total of all chemical reactions that occur in an organism. Frisch and Revelle cannot say that the complete metabolic level, or some specific metabolic system (essentially, a chemical reaction pathway) is what corresponds to the "critical metabolic level", however, their hypothesis is at least testable in terms of general and specific metabolic patterns.

Menarche provides a convenient measure of some degree of maturation in girls. Obviously, it represents a degree of maturation of the uterus. As was mentioned above, there is a degree of correlation between the average age at menarche and the average age of initiation of both height spurts and weight spurts; menarche usually occurs then during the falling phase of the adolescent height spurt; that is, sometime after peak height velocity has occurred. No such convenient signpost for sexual maturation is available for adolescent boys. However, the average age differential between peak height velocity in boys and girls has remained at a fairly constant 2 years. Thus Frisch and Revelle's hypothesis concerning critical weight-adolescent event at least superficially applies to both sexes.

v. *Hormones and Adolescents*

Human organisms are like their non-human counterparts in that they possess two types of coordinating systems, or systems which by their interactions with the environment and with other organs and tissues of the body bring about the integrated activity of the entire organism. The first of these is a fast coordinating system, the nervous system. The other system is the endocrine system which is a slow coordinating system. Both of these systems affect each other, and the distinction between fast and slow coordination can become blurred.

The endocrine system consists of masses of tissue scattered throughout the body. It is a function of these masses, or glands, to produce chemical signals which are elaborated directly into the circulatory system. By means of the circulatory system, these chemical messengers eventually arrive at specific target organs, the cells of which then respond. There are no direct pathways between the endocrine glands and the target organs; rather, the level of a particular hormone in the blood is a function of the activity of the endocrine gland producing the hormone.

This fact uncomplicates the studies of hormones, especially when they are related to other physiological parameters such as age, sex, nutritional level, developmental status and so on. The endocrine glands differ from other glands (exocrine, eccrine) that produce specific substances in that the endocrine glands are ductless, and their metabolic products leave the gland by diffusion directly into the circulatory system, whence they are carried to all parts of the body.

The hormones particularly concerned in growth are the following:

Hormone	Source
Thyroxin	Thyroid gland
Cortisol (Cortisone)	Adrenal cortex
Adrenal Androgens	Adrenal cortex
Testosterone	Testes
Estrogen	Ovary
Insulin	Pancreas
Growth Hormone	Pituitary gland
Thyroid stimulating Hormone (TSH)	Pituitary gland
Adrenocorticotropic Hormone (ACTH)	Pituitary gland
Follicle-stimulating Hormone (FSH)	Pituitary gland
Luteinizing Hormone (LH)	Pituitary gland

As the above list implies, there are interrelationships between the secretions of the various hormones. In general, the pituitary gland is the master gland, the target organs for the hormones it produces are, for the most part, other endocrine glands; thus, the function of the thyroid-stimulating hormone (TSH) is to cause the production of thyroxin by the thyroid gland, ACTH stimulates the adrenal cortex to produce its hormones, and so on. The pituitary gland is found at the base of a portion of the brain called the hypothalamus. As will be pointed out later, the nervous tissue of the hypothalamus is involved in the control of the secretions of the pituitary gland. The advantage in having two or three organs interposed between the initiator of a particular response and the target organ of a particular hormone (e.g., hypothalamus → pituitary → thyroid → general body cells) are two-fold: 1) feedback loops can be established whereby the the ultimate level of a hormone in the tissues can be controlled by that level; for instance, as the level of thyroxin rises in the circulating blood, the thyroxin level will eventually affect the functioning of the pituitary, essentially decreasing the production of TSH which then affects the production of thyroxin, essentially decreasing it. As the level of thyroxin drops, the inhibition of the production of TSH by the pituitary is released. Under this set of conditions, the concentration of thyroxin in the blood can be maintained at a fairly constant level.

The second advantage of this complex system is that the hypothalamus can control the level of operation of the feedback loops described above. The hypothalamus, as a part of the nervous system, is constantly receiving from internal and external sensory receptors(e.g., muscle spindle receptors, blood carbon dioxide receptors, and so on) information concerning the external and internal environment of the individual involved. The hypothalamus can then act to set the level of sensitivity of the pituitary gland to a particular value. Incidentally,the approximate position of the hypothalamus - pituitary complex can be imagined by placing one finger on the bridge of the nose, and another finger in the ear; the point of intersection of two imaginary lines from these points crossing at a right angle is the approximate location of the hypothalamus- pituitary complex.

The general functions of the hormones listed previously are as follows:

1. Thyroxin (thyroid hormone)	Necessary for proper development of the brain, especially in foetal life. In later life thyroxin regulates the level of oxidative metabolism, the energy-releasing chemical reactions in the body.
2. Cortisol (Cortisone)	In general, has an anti-inflammatory or anti-stress function; inhibits incorporation of amino acids into muscle, stimulates the formation and storage of glycogen, a carbohydrate energy storage product, from non-carbohydrate sources, primarily protein. Secretion rate increases with increases in stress due to infection, extreme exercise, or emotional stress.
3. Adrenal Androgens	Causes some pubertal changes; involved with production of pubic and axillary hair; implicated in adolescent growth spurt; implicated in maintaining secondary sexual characteristics in males; especially maintenance of muscle bulk.
4. Testosterone	In prenatal period, causes differentiation of the hypothalamus; causes prenatal differentiation of external genitalia into a penis and scrotum; excess of male

		growth spurt over female growth spurt; establishment and maintenance of secondary sexual characteristics, especially the beard, testes, and penis; support or maintain sexual behaviour (mating behaviour) patterns.
5.	Estrogen	Produced by both sexes; development and maintenance of secondary sexual characteristics in female including sexual behaviour; involved in menstrual cycle.
6.	Insulin	Stimulates glycogen formation and storage from glucose, a carbohydrate source; stimulates glucose oxidation for energy production.
7.	Growth Hormone	Participates in and stimulates general growth; implicated in adolescent growth spurt, probably works synergistically with adrenal androgens.
8.	Thyroid stimulating Hormone (TSH)	Stimulates hormone production by the thyroid gland.
9.	Adrenocorticotropic Hormone (ACTH)	Stimulates hormone production by the adrenal cortex.
10.	Follicle stimulating hormone (FSH)	Stimulates in girls development of the ovarian follicles; participates in ovulation in cooperation with estrogen. In males, it participates in the development and maturation of the semeniferous tubules.
11.	Luteinizing Hormone (LH)	Stimulates the growth of the corpus luteum in females. The corpus luteum is composed of follicle cells which do not

leave the ovary after ovulation; they become a secondary endocrine gland which secretes progesterone. This hormone has two functions: 1) maintenance of the uterine wall (its loss is apparent as the onset of menstruation); 2) maintenance of the integrity of the placenta during pregnancy.

Studies in adolescent endocrinology suffer from several problems: 1) few, if any, longitudinal studies have been performed for any particular endocrine system, consequently baseline data necessary for establishing norms and standards for further research are lacking, 2) correlations of physiological age as demonstrated by skeletal maturity with endocrinological data are rarely done, and 3) few studies have been done on the interrelationships among hormone production in adolescents. While there is no lack of competent researchers in endocrinology, and while no physiological system has a greater effect on the changes that compose adolescence, no one seems willing to invest the time and money necessary to generate the long-term longitudinal studies required to fill this gap.

Visser (1973) has reviewed studies done on the endocrinology of adolescence. He very rightly points out that most of these studies are cross-sectional, and do not show the sequence of events that occur in individual boys and girls. However, general trends in hormonal events during puberty are described. In boys, the onset of pubertal development is correlated with an increase in the plasma (blood) concentration of luteinizing hormone (LH). Plasma testosterone concentrations begin to show an increase and a steady rise in levels beginning with Tanner's stage 2 maturation level. This increase in plasma testosterone level is maintained at a slower pace as age increases and finally levels off to constant value in the adult. The pubertal age at which plasma testosterone reaches one-half the adult value is between stage 3 and 4 on the Tanner scale, and corresponds with a skeletal maturity level (bone age) of 13½ years (Burr et al., 1970). Testicular volume and plasma testosterone levels curves parallel each other (August et al., 1972). In this study, plasma testosterone levels reach one-half the adult value at a bone age of 14, corroborating the Burr et al. study. Follicle-stimulating hormone (FSH) levels in plasma do not begin to increase until after the increase in LH levels. The increase in LH levels also precedes the increase in testosterone levels (Werland et al., 1970). In females, the first hormonal event of puberty is an increased concentration of plasma FSH, followed by an increase in LH levels. Penny et al.(1970) found that FSH levels increase most through chronological ages 5 to 8 in females; while LH levels increased most during chronological ages 9 to 10. Jenner (1972) found good correlation between pubertal age and plasma LH concentrations, and pubertal age and FSH plasma levels, thus corroborating Penny's work. Further, Jenner correlated plasma levels of 17-Beta estradiol (an estrogen) with pubertal age. Estrogen levels were undetectable in females in stage 1 of puberty (Tanner scale).

The greatest increase in plasma estrogen level came between pubertal stages 2 and 3, though the level of plasma estradiol did not reach one-half the value of that found at pubertal level five until stage 3 pubertal level had been passed. In general, then, there is an increase in gonadotropic hormones during puberty until the adult level is reached and maintained.

There is evidence that the timing of puberty, or the onset of puberty is under control of the central nervous system, and mediated through hypothalamic control of the pituitary gland. Testes or ovaries of prepubertal animals transplanted to adult castrates begin to function in an adult fashion almost immediately (Harris and Jacobsohn, 1952; Harris, 1964; Donovan and van der Werfften Bosch, 1965). Conversely, the results of the accidental ingestion by small children of male or female sex hormones indicates that breasts, uterus, and penis will respond to hormone stimulation. What is lacking in prepubertal children is not the capacity for development, but the lack of proper hormone levels to bring about sexual maturation. Nor is the pituitary gland the controlling agent in the timing of the onset of puberty. Pituitary glands from prepubertal rats transplanted into adult sexually mature rats whose own pituitaries have been removed begin to function in adult fashion very quickly. Visser proposes that the hypothalamus acts as a "gonadostat". In the prepubescent child, the hypothalamus is extremely sensitive to circulating levels of gonadotropics (FSH, LH, estrogen, testosterone). By feedback control, this high sensitivity keeps the levels of these hormones at extremely low levels during the prepubertal period. Whatever internal and external environmental factors are involved (total body mass as postulated by Frisch and Revelle,1970) the hypothalamic cells lose their sensitivity to increased levels of circulating gonadotropin , allowing an increased production of these materials. The end result is that the organs involved in the primary and secondary sexual characteristics respond by growing and developing, it already having been shown above that they are indeed competent to do so. Eventually the hypothalamus stabilizes at a new or adult level of sensitivity, and in that sense operates as a gonadostat.

Other hormones have not been very well studied in relationship to adolescence. Apparently this hormone is not secreted continuously, but production increases have been noted under conditions of decreased blood sugar, rise in certain amino acid blood plasma levels, physical exercise and emotion. Finkelstein et al. (1972) studied age-related changes in the 24-hour secretion rate of growth hormone by sampling subjects every 20 minutes in a twenty-four hour period. Prepubescent children averaged 91 micrograms per day of somatotropin; the bulk of it was secreted in 110 minutes. Adolescent children produced on the average 690 micrograms of growth hormone; the average time of secretion was 226 minutes in a twenty-four hour time period. Young adults produced on the average 385 micrograms per day, of which 133 minutes per day were spent in growth hormone production. In subjects over 41 years of age, both the levels of growth hormone production and the time spent in growth hormone production decreased to zero values with increasing age. Greenwood, Hunter, and Marrian (1964) examined growth hormone levels in children and adolescents. They found that plasma levels of growth hormone vary considerably and rapidly during the day for individuals. Children and adolescents show a twenty-fold difference in concentration from adult plasma of growth hormone within 2 to 3 hours after a meal. Curiously, they found that plasma growth hormone levels did not correlate with either chronological age or growth velocity.

The relationship between thyroxin function and general metabolism has led to several studies on the changes in this hormone's level during adolescence. In a study conducted at the Royal Victoria Hospital, Montreal, Quebec, Canada, Hart and McKendry (1967) studied serum protein-bound iodine (PBI) levels in 282 adolescents ranging from 10 to 18 years of age. PBI levels are indications of thyroid function, hence thyroxin production. They found that PBI levels were influenced by sex, with boys having slightly lower levels than girls of all ages. Boys under 14 years of age (chronological) had slightly lower levels than older boys. Other than these two positive findings, they could find no statistically significant correlations between PBI levels and growth rate, sexual development, or intelligence. Oddie and Fisher (1967) found a decrease in thyroxin iodine levels (established from PBI levels) to a minimum level at an average chronological age of 15.0 years for boys and 13.7 years for girls. Beyond these ages, thyroxin iodine levels rise to approach adult levels. These data agree with those of Malvaux et al. (1966) who found that free thyroxin levels in adolescent males is decreased relative to adults, and minimum values are achieved in the later stages of sexual maturation. Vlasenko (1972) reported on the accumulation of iodine in the thyroid glands of normal and physically/sexually underdeveloped adolescents ranging from 11 to 18 years of age (chronological). Relative to normal adolescents, iodine accumulation was decreased in sexually underdeveloped adolescents, and substantially decreased in adolescents judged to be both sexually and physically underdeveloped. These data would suggest that physical maturation and sexual maturation are separate but more-or-less linked growth functions, and that thyroxin has an effect on both growth functions.

Lamberg et al. (1973a, 1973b) have studied both serum thyrotropic hormone (TSH) and serum thyroxin levels in adolescent children, most especially in adolescent girls relative to menarche. In 8 to 20-year-old subjects, the peak of TSH production was reached within 0.5 years post-menarche. TSH values for adolescent girls 12 to 16 years old were higher than for boys 12 to 16 years old. Levels in adolescent boys and girls aged 12 to 16 years were higher than in normal adults. Concerning both total and free serum thyroxin levels (some thyroxin is bound to certain serum protein), they concluded that the maturation process in girls involves an increase in both the total and free thyroxin levels. Their data do not provide any answers to the biochemical events that link maturation and increased thyroxin production.

vi. Secular Trends in Growth and Development

It has been established that for at least the last hundred years, there has been a striking tendency for children to become larger at all ages, and to achieve sexual maturity earlier. This tendency is known as the secular trend. Groman, Dalberg, and Lichtenstein (1942) plotted average height against chronological age for school children in Sweden. The differences range from an average of 13.6 cm (5.4 inches) at age 12 to 5.5 cm (2.1 inches) at age 18 for girls. For boys the differences range from 12.7 cm (5.0 inches) at age 12 to 9.1 cm (3.6 inches) at age 18. Similar results can be obtained from Aubenque (1957). He plotted average high in centimetres against chronological age for French University students by date of birth. At 17 years of age, subjects born in 1925 were almost 4 cm (1.5 inches) shorter than 17 year old students born in 1933. While the gap between the two groups narrows considerably as age of the subjects increased, later-born students kept their height advantage at least through age 20. Similar trends are shown for American children (Tanner, 1970), with children in the age range of 5 to 7 years increasing by 1 to 2 cm for each decade since 1900, and children in the age range of 10 to 14 years increasing by 2 to 3 cm for each decade since 1900. Tanner has evidence (unpublished) which suggests to him that in North American populations which are most well-off (undefined) that the population is growing and maturing close to or at its fastest possible speed. Veli (1971) found that for Hungarian adolescent girls ranging in age from 10 to 16 that, 1) the total average growth increment in both height and weight was greater for girls who had achieved these age groups in 1962 than for girls who had achieved these age groups in 1947, and 2) the age at which the greatest increment in growth occurred had dropped.

A secular trend in the average age of menarche has also been observed. The most stunning trend is shown for adolescent girls in Norway; in this group the average age at menarche has decreased from 17.2 years in 1850 to 13.3 years in 1950 (Tanner, 1962). Similar secular trends have been established for adolescent girls in Sweden, Finland, Great Britain, and the United States. Whether this trend is continuing in well-off populations is in doubt. Data from a study by Maresch (1972) would indicate otherwise. In this continuing longitudinal study of subjects by the Child Research Council of the University of Colorado Medical Center Pediatrics Department, subjects were divided into earlier-born (for girls, birth date before January, 1940; for boys, birth date before January, 1936) and later-born groups. For earlier-born girls the average age at menarche was 13.01 years of age with a standard deviation of 1.03 years; for later-born girls the average age at menarche was 13.20 ± 1.26 years. Average age for the fusion of the epiphysis of the humerus to the shaft of the humerus was 12.23 ± 0.97 years for earlier-born girls and 12.34 ± 0.92 years for later-born boys. Similar relationships are shown for average height and weight at 9 years of age for earlier-born and later-born subjects. For earlier-born girls, average height was 134.54 ± 7.73 cm (53.0 - 2.2 inches) compared to 132.46 ± 5.61 cm (52.3 ± 2.2 inches) for later-born girls. For earlier-born boys, average height was 134.35 ± 4.63 cm (52.6 ± 1.8 inches) for later-born boys 133.73 ± 4.35 cm (52.6 ± 1.7 inches). Weight at age 9 for earlier-born girls was 29.93 ± 4.82 kg (66.0 ± 10.4 pounds) and 28.57 ± 4.18 kg (62.9 ± 9.2 pounds) for later-born girls. For boys, the average 9-year weight for early-born subjects was 29.79 ± 3.79 kg (65.4 ± 8.1 pounds); for later-born subjects 29.23 ± 3.09 kg (64.5 ± 6.8 pounds). These data indicate, at least for this group, an indication of the cessation of the secular trend for age at menarche, weight and height.

Hansman (1972) who suggests that the studies showing a secular trend in menarche may be an artifact cites Maresh's study as evidence. Further evidence for the artifactual nature of the so-called secular trend in the age of menarche is presented in a table that presents the results of studies from 1832 to 1971 on the average age of menarche, and most importantly, the range of ages in each study over which menarche occurred. The earliest study, conducted on 450 female patients in Manchester, England, in 1832, yields an average menarcheal age of 14.7 chronological years, with the range over which menarche occurred running from 10.5 to 19.5 years. The latest report presented, that of Maresh, for 92 upper middle-class girls in Denver, Colorado, yields an average menarcheal age of 13.1 years, but a range of from 10.5 to 15.5

years. What is significant to Hansman is that the lower limits of the range have not changed, while the upper limits have. Of the eight studies presented, the lower limits of menarcheal age range from 9.5 years to 10.5 years while the upper limits range from 20.5 to 15.5 years. On the aggregate, the result is that the average of menarche shows a drop from 1832 to 1971. Since the lower limits of the range have not changed, Hansman maintains that what has occurred is that more girls are apt to menstruate sooner than previously, probably because of better nutrition and better medical care. She maintains that there is no clear evidence that present-day youth are experiencing pubertal changes at earlier ages. If this were so, then the range for the onset of menarche would have shifted to lower values. It is interesting to note that the lower limits of the range, which seem to have been invariant for 140 years, probably represent an inherent biological limitation in human populations concerning the maturation of the hypothalamus-pituitary gland-gonadal axis.

It will be interesting to follow future reports on the average age of menarcheal onset and the range of ages over which menarche occurs. If the present world conditions of decreased food supply and decreased quality of living caused by world-wide inflation continue then verification of Frisch and Revelle's critical weight-adolescent event hypothesis may come from the expected decrease in the rate of growth and weight of the child segment of the human population. Increase in the average menarcheal age without increase in the lower limits of the range of menarcheal age would substantiate Hansman's claim that pubertal changes are not occurring any sooner, i.e., that the secular trend is a statistical manifestation, rather than an expression of the events occurring in the real world.

vii. Growth Standards

Growth standards have been prepared for the following groups of children: Finnish (Backstrom and Kantero, 1973), English (Tanner and Whitehouse, 1959), and white American (Hodges and Krehl, 1965; Jackson and Kelly, 1945; Falkner, 1962; Stoudt et al., 1960). A special committee of the International Union of Nutritional Sciences strongly recommended that a coordinated study of physical growth standards in selected populations of the world be prepared (Falkner, 1972). It was urged that the results be suitable both as standards of assessing changing growth patterns as a result of ecological change in individual countries, and for comparison of genetic differences between various ethnic populations. It was suggested that measurements of the variety listed below be performed on all selected children at birth; 3, 6, and 9 months; 1 year, 15 and 18 months plus or minus 2 weeks; 2 through 18 years of age plus or minus four weeks. The following measurements would be included in the study: 1) nude weight, 2) height or length, 3) head circumference up to three years of age, 4) arm circumference at the midpoint of the upper left arm, 5) triceps skin-fold at the same point as the arm circumference is taken, 6) chest circumference, 7) number of deciduous teeth erupted at the time of examination of children under two years of age. An erupted tooth is defined as one whose crown surface is exposed.

In considering cross-sectional standards for a national survey, the following percentages of the sample size to be included are as follows: 1) 13 per cent of the whole sample from birth to one year, 2) 5 per cent of the whole sample from ages 7 and 8 years, and 3) 10 per cent of the whole sample size around peak growth velocity. Their recommendations for sample size cover only the first four years and are as follows:

	Number of Individuals	
Age	Male	Female
Birth	250	250
3 months	100	100
6 months	100	100
9 months	100	100
1 year	100	100
15 months	100	100
18 months	100	100
2 years	100	100
3 years	100	100
4 years	100	100

Clearly, these recommended studies are meant to be both longitudinal and continuous; that is, as soon as one group begins and is followed, another group should be started within a reasonable length of time, say, one year. These continuous longitudinal studies can yield cross-sectional data concerning the state of the child population in any region at any one time. Conversely, longitudinal data begun at one-year intervals would provide data on trends or patterns of change occurring in a given population of children. Changing trends could or should have pronounced affects on educational and social welfare policies. Computerization of such data, and analysis thereof, while perhaps initially expensive, can yield rapid analyses. Internationalization of such data, and ready access to them, will allow cross-cultural and cross-ethnic comparisons to be made.

Such a cross-comparative study has been made by Walker and Richardson (1973) among four classes of pre-school children in South Africa ages 2 to 6 years: 1) Negro, rural general population; 2) Negro, urban general population; 3) Negro, nursery school population; and 4) whites, nursery school children from different social classes. These children were examined for weight and evidence of protein-caloric malnutrition (PCM). Underweight was defined as that proportion of children 60 per cent or less of the mean weight-for-age of Iowa children (Jackson and Kelly, 1945). Overweight is defined as the proportion of children 20 per cent or above the mean weight-for-age of Iowa children. The group comprising the Negro standard was the Negro nursery school children; this group was selected because two meals a day were provided them at school. The following conclusions were reached: 1) among Negro nursery school children, in contrast to the other two Negro groups, underweight was virtually absent both by the Negro standard and the Iowa standard; 2) among nursery school Negro children clinical PCM signs were virtually absent (0.8%) when compared with the other Negro populations (rural Negroes, 7.0%; urban Negroes, 5.0%); 3) evidence of overweight is apparent in all three Negro children populations by both Iowa and local Negro standards; 4) overweight is a serious health problem in white nursery school children (none of the 379 white children was underweight by either standard; 5.0% were overweight by the Iowa standard and 19.4% were overweight by the local Negro standard).

Walker and Richardson fear that international standards as proposed by the International Union of Nutritional Sciences may stigmatize those members of the population that do not attain them. Further, they feel that the growth measurements proposed by the commission are inadequate, and cite work by themselves and others (Walker, 1965; Leverton, 1964) on non-dietary factors that can contribute to the total health picture, or are at least associated with it, e.g., resistance to infections, attendance at school, initiative and prowess at work and play, versatility of leisure interests and activities, and so on. Walker and Richardson also urge that the international standards as proposed have the serious drawback of relating to only a short period in the lives of the persons involved. It is apparent that their concern is not for the health and well-being of nursery children, but the health and well-being of people from birth through childhood and adolescence, and through maturity to death. Such should be the concern of any educational system which must be integrated into the social fabric of any society even though its primary concern is with the first years of human existence.

3. Other Physiological Levels and Events in Adolescents

i. Introduction

Studies on the physiology of adolescents other than growth and development are rare. Many of them are useless or nearly so because of their dependence on chronological age rather than maturational age as determined by skeletal radiograms, Tanner standards for sexual maturity or Young's standards for sexual maturity. Whether one chooses maturation age or chronological age as the time base, the variations in pooled data may well obscure the true physiological events. For example, pooled average data for height velocity from several individuals do not show the sharp onset of the adolescent growth spurt, its steep rise, and equally steep decline. Keeping these warnings in mind, one should approach the data presented in the following sections with a bit of caution.

ii. Digestion and Nutrition

The general function of the digestive system is to obtain the necessary molecular species from the environment and then to process them so that they can be assimilated into the tissues of the body. Strictly speaking, the cavity of the digestive system is outside the body, in the same sense that the hole in a doughnut is outside the doughnut. Processing of obtained nutrients means that large masses and large molecules must be broken into small enough units; these small units are of sufficient size that they are capable of diffusing into and through the cell membranes of certain cells lining the digestive tract. At this time, these small molecular species are inside the organism. Nutrient materials are divided roughly into two classes: those needed in large amounts (macronutrients) and those needed in small amounts (micronutrients). The major macronutrients fall into the chemical classes of carbohydrates, fats, and proteins. Macronutrients are usually needed for two purposes: 1) to provide the building blocks whereby new cells can be produced, and 2) to provide the energy which is necessary to run the chemical reactions which are the molecular base of all the activities of all organisms, from simple cell function through complex behaviour patterns. If new cell production exceeds old cell destruction, then growth occurs, hence nutrient procurement and processing are vital areas of human activity upon which adolescent growth and development hinge.

Micronutrients, or nutrients needed in small amounts, include many chemical elements (e.g., boron, zinc, molybdenum) and a small number of chemical compounds, usually classified as vitamins. Most, if not all, micronutrients participate in chemical reactions as catalysts or co-catalysts; consequently they can be recycled for use within the body, though apparently not forever.

Dietary intake does have an effect on skeletal maturation as reported by Frisancho et al. (1970). In a study of 7,974 rural children aged 1 to 22 years from six central American countries whose dietary intake of the major macronutrients was judged to be low, they found that retardation of skeletal maturation was much greater during childhood than during adolescence. Not surprisingly, both sexes seemed to be equally delayed.

While all the macronutrients are used to a greater or lesser degree for the production of new cells, all of them can be used as energy sources to drive other chemical reactions. Therefore, it is convenient to reduce food intake to a common energy denominator, the calorie. The food calorie is the physicist's kilocalorie; it (the food calorie) is defined as the amount of energy required to raise the temperature of 1,000 grams of water from a temperature of 14.5^{o}C. The caloric content of nutrients can be easily found by burning the nutrient(s) in a device known as a bomb calorimeter. Energy intake of well-nourished children and adolescents was studied by Wart et al. (1969). The average total energy intake of 715 subjects aged 1 to 20 years, including both boys and girls, was compared with various physical measurements made on each subject. They found that the average total energy intake per day of both boys and girls increased with 1) age, 2) increased body weight, 3) increased body height, and 4) increased body surface area. At every age and size bracket, the mean energy intakes of boys were greater than the mean energy intakes of girls. In every case relationships were greater between total intake and body size by whatever measure than between total intake and age (an indication of the futility of using chronological ages for adolescent studies). Rates of increase of total energy intake coincided with rates of growth. Intakes of older adolescent girls were lower than those of the same age or size who were still growing. They concluded that children of the same age and size do not necessarily need the same amounts of food.

Though such studies and their well-warranted conclusions would militate for attention to individual dietary needs, reports continue to be published on standards of human calorie and protein requirements. De Wijn (1967) suggests the following as values of macronutrients which provide adequate nutritional health in the adolescent period: 1) 3 to 5 meals per day; 2) protein should provide 10 to 14 per cent of the calories required, fat should provide 25 to 35 per cent of the caloric intake, and carbohydrate the remaining 51 to 65 per cent of the caloric intake; 3) protein should be provided at a level of 1.5 grams of protein per 1 kilogram of body weight. Of the protein provided, he suggests that one-third to one-half of it be "of the highest biological value". By this, he means from an animal source (i.e., meat); plant proteins tend to have lower than animal values for two amino acids in particular, viz., lysine and arginine. These amino acids are necessary for proper cell multiplication, that is, new cell formation; their lack would interfere with new cell production and consequently growth. Hence, adolescents who are growing will probably require higher percentages of high lysine-arginine proteins than would other humans during which growth is minimal or nil.

Swaminathan and Parpia (1971) recommend calorie and protein requirements somewhat at variance with De Wijn. They project calorie requirements from basal metabolism rates (see below) and recommend that for adolescent boys aged 13 to 18, caloric intake should be at a level 90 per cent above basal metabolic rate; and for adolescent girls aged 13 to 18, caloric intake should be at a level 80 per cent above the basal metabolic rate. Projected minimum protein requirements in grams of protein per kilogram of body weight were as follows: for 10 to 12-year-old-girls and boys, 0.88 to 0.82; for 13 to 18-year-old boys 0.81 to 0.65; for 13 to 18-year-old girls, 0.75 to 0.61. They maintain that these recommendations correspond with calorie requirements as expressed by the United Nations Food and Agricultural Organization Expert Committee on Calorie Requirements.

Wart _et al_.'s conclusion that children of the same age and size do not necessarily need the same amount of food seems to coincide with the true nature of adolescents and adolescence. Rather than trying to insure, through school lunch programs that children on the average would receive a balanced diet, it would be more valuable in terms of community health to periodically examine all children for clinical signs of protein-calorie malnutrition, and vitamin deficiency. In those individuals where PCM is detected, a follow-up home visit program by carefully-trained nutritional social workers would probably be more effective in eliminating PCM. A vigorous and well-planned nutritional health curriculum may be as effective as home visitations.

iii. Metabolism and Respiration

The human organism requires oxygen for continued life. In the series of chemical reactions, in which the energy in chemical bonds is released in such a manner that it can be used by the human organism, the final chemical reaction is the capture of hydrogen atoms by atomic oxygen which is obtained from the environment by respiration. If this final reaction is interfered with, the chemical reactions preceding it eventually cease, and no more activity occurs; that is, the organism no longer functions and is dead.

To simplify the calculations of and comparisons of energy produced by organisms, these measurements (in cubic centimetres) of oxygen consumed per gram body weight per day, or in calories of energy produced per square metre of body surface per hour are done under conditions which are designed to minimize as many variables as possible. The subject should be reclining, physically and mentally relaxed, should not have eaten for from 12 to 14 hours, and should be in an environment of known and constant temperature following 30 to 60 minutes of horizontal rest. The value obtained is called the basal metabolic rate (BMR). Needless to say, it is notoriously difficult to obtain BMR values for children (Sargent, 1961, Shock, 1966). They, the BMR values, disagree widely in terms of absolute values. The reasons for the variance in absolute values need not concern us here, they are primarily methodological. However, the trends observed in different studies are consistent in their major characteristics: 1) basal metabolic rates begin to increase very soon after birth (within minutes); reach a peak sometime in the first year; 2) this value remains relatively constant over the next year or so until the third year; 3) a decline begins after this period which continues over the remainder of the life span. There are sex differences associated with BMR. Though there is no difference observed in infancy and early childhood, such differences do become apparent eventually, with boys achieving a higher metabolic rate than girls. This sex-associated difference remains throughout life. Various explanations have been presented to account for this difference. For instance, males generally have a higher muscle to fat ratio than females. Since muscle has a higher metabolic rate than fat, this would produce the observed sex difference in BMR. There is some evidence that hormonal factors may play some role in determining BMR, e.g., Clark and Garu (1953) found a positive correlation between basal metabolic rate and adrenal androgen production in boys, but not in girls.

Evidence on the relationship between the adolescent period and changes in the basal metabolic rate is inconclusive. However, Erchorn (1955) and Shock (1943) detected what they felt were changes between adolescent events (specifically menarche, and adolescent growth spurt), namely a prepubertal slowing of the deceleration in metabolic growth rate. The metabolic rate does not increase in adolescence, rather (if anything) the metabolic rate simply does not decline as rapidly as it does during other periods of human life.

Lung function and respiratory activity are obviously related to metabolic activity. The lungs are the organs across which oxygen diffuses into the organism. It is necessary that the supply of oxygen at the lung surface be constantly replenished since it is being constantly depleted. In the human organism, the respiratory surface is sequestered within the organism, consequently a fresh supply of oxygen must be actively moved to the respiratory surface. This respiratory activity is accomplished automatically by cyclical contraction and relaxation of the intercostal (between the ribs) and diaphragm muscles. As a child grows the total oxygen consumption by that individual will increase, even though the basal metabolic rate decreases. Lung size and respiratory ability must increase with increasing size to satisfy the total energy requirements of the individual.

Frequently assessed values of respiratory function are the following: 1) tidal volume, the amount of air moved into or out of the lungs with each breath during normal quiet respiration; 2) vital capacity, the largest volume of air that can be expired after a maximal inspiration and 3) functional residual capacity, the amount of air left at the end of a passive (not forced) expiration. Vital capacity has been related to age in several studies. Generally, vital capacity increases with age. In a study by Ferris et al. (1952) average vital capacity increased in males from 800 ml at age 4 to 4,400 ml at age 18; average vital capacity increased in females from 600 ml at age 4 to 4,000 ml at age 18. Respiration rate decreases within increasing rate. Iliff and Lee (1952) found the basal respiratory rate decreased in males from an average of 25 movements per minute at age 2.5 to a rate of 19 per minute at age 13.5. For females, the decline was quite similar from 25 per minute to 18 respiratory movements per minute at corresponding ages.

Recent advances in technology have allowed more sophisticated studies of lung capacity to be made. A few of these studies involve adolescents. For instance, Dickman et al. (1971) used a completely automated on-line computerized spirometry method to measure the following in a group of 482 males and 468 females aged 5 to 18 years: 1) forced vital capacity (FVC), 2) the volume of air expired in the first second of a forced expiration (FEV $_{1.0}$), 3) maximal expiratory flow (MEF), and 4) maximal mid-expiratory flow (MMEF). For data analysis, children were grouped by two inch increments from 42 to 78 inches. Height was found to be a more reliable index of pulmonary development than was age. (This is not surprising as height has been shown above to be more closely related to physiological age than is chronological age). In children less than 60 inches tall, values for the four measurements were very similar for boys and girls. Above that height pulmonary function increased rapidly, peaked at age 18, and declined with increasing age. In girls, values increased until age 16 on the average, and then levelled. Equations generated from these data for predicting FVC, $FEV_{1.0}$, MEF, and MMEF are functions of height (up to five feet) for younger children; and rather more complex functions of height and age for older and taller subjects. No relationship was found between the ratio $FEV_{1.0}$/FVC and sex, age, or height.

A similar study was conducted by Zapletal et al. (1969). This group measured the following items in healthy 6 to 18 year olds: 1) mamimum expiratory flow volume rates (V_{max}); 2) airway conductance, (G_{aw}); 3) total lung capacity (TLC); 4) vital capacity (VC); functional residual capacity (FRC); and forced expiratory volume in the first second of expiration ($FEV_{1.0}$). They found that TLC, VC, $FEV_{1.0}$ increase more (per cent height increase) as growth proceeds. The increase in these parameters is greater for girls than for boys. V_{max}; G_{aw} at different lung volumes are closely related to height; but the ratios $V_{max\ 3}$TLC and G_{aw}TLC and G_{aw}TLC are independent of height. The relationships between these various parameters are consistent with the hypothesis that the lungs and the airways to the lungs (which are not, or do not) function as respiratory surfaces grow equally in function and capacity between ages 6 and 18.

iv. Circulation

The function of the circulatory system is the transfer of materials from one part of the body to another. We have already noted that hormones, the products of the endocrine glands, are transferred via the circulatory system. Likewise, oxygen is transferred from the lungs to all the cells of the body; and conversely, carbon dioxide is transferred from the cells of the body to the lung surface for discharge. Urea, which results from the degradative metabolism of proteins, is transferred from all the cells of the body to the kidneys for elimination. Foodstuffs are transferred from the intestinal surface to all cells of the body.

The circulatory system in man consists of a four-chambered heart; arteries, which carry blood (the circulatory fluid) away from the heart; veins, which carry blood toward the heart, and capillaries. These latter structures are interposed between the smallest arteries and the smallest veins, are extremely thin-walled, and are the site of exchange of materials between the circulatory system and the other cells of the body. Since materials enter or leave the circulatory system primarily by diffusion, a spontaneous thermodynamic process, and since cells need a certain minimum supply of materials, no cell can be more than 0.1 to 1.0 mm (1/250 to 1/25 inch) from a capillary. Consequently, the number of capillaries, and the surface area of the capillaries is enormous.

The direction of flow in the circulatory system is one-way; that is, it does not oscillate back and forth. The heart pumps the blood out the arteries, which branch and sub-branch many times; the tiniest branches lead into capillaries; the capillaries lead to the smallest veins which combine and recombine into larger veins which eventually return the blood to the heart.

The circulatory pattern in man consists of two complete circuits; a pulmonary or lung circuit and a systemic circuit which are separate from each other but do intersect at the heart (see Figure 2). The circulatory fluid is the blood, consisting of about equal parts fluid (plasma or serum) and cells. The vast majority of the cells are red blood cells; their primary function is the transfer of oxygen from the respiratory or lung surface to all the cells of the body. Other cells are the white blood cells; they function in disease protection by engulfing bacteria which enter the body, and by producing antibodies against them. Unlike the red blood cells, some of the white blood cells can leave the circulatory system and migrate to sites of bacterial infection.

Paralleling the venous side of the blood circulatory system (but not the arterial side) is a system of capillaries and veins. This system, the lymphatic system, has several functions: 1) the return of fluid expressed out of the blood circulatory system at the capillary level; the largest lymphatic veins eventually discharge their contents into the systemic veins, item 5 in Figure 2, near the heart; 2) a disease-prevention function. In various parts of the lymphatic system, the vessels under and at these points are interlaced with strands of connective tissue on which are located various cells capable of engulfing and destroying bacetria. These structures in the

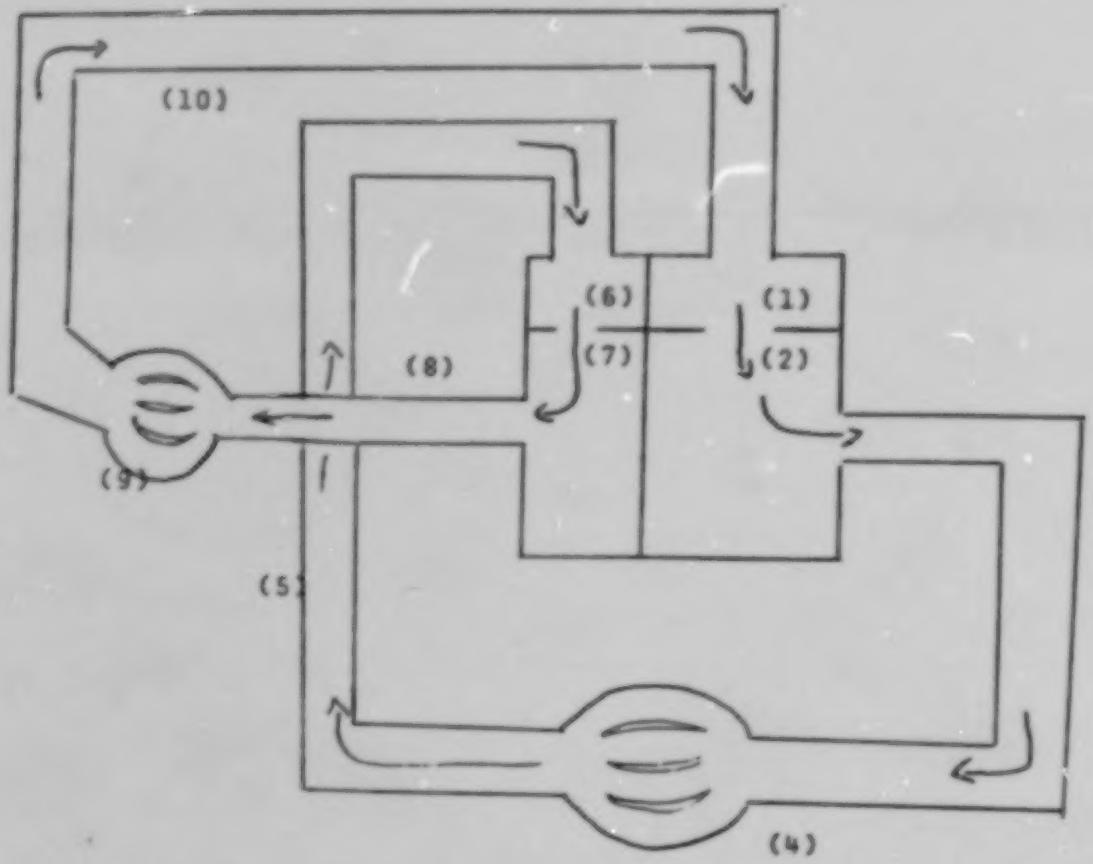

Figure 2. Diagram of the Circulatory Pattern in the Postnatal Human. Arrows indicate direction of blood flow.

1. Left auricle of heart
2. Left ventricle of heart
3. Systemic arteries
4. Capillaries in the body
5. Systemic veins
6. Right auricle of heart
7. Right ventricle of heart
8. Pulmonary arteries
9. Capillaries of the lungs
10. Pulmonary veins

lymphatic system are the lymph nodes; the tonsils and the adenoids are specific examples of lymph nodes. Bacteria seem to be preferentially shunted to the lymphatic system; apparently the idea is to capture and destroy the invaders before they reach the blood circulatory system. The lymphatic system also functions in viral infections, as can be evidenced by the "swollen glands", which are really lymph nodes, found in the neck, under the armpits, and the groin when one has a severe cold.

As the heart beats, it exerts a force on the blood. In turn, this force is exerted against the arterial walls. The amount of force exerted on a given area of the arterial wall is the blood pressure. For clinical purposes a back pressure of equal value is exerted on the arterial wall. This pressure is then standardized against the amount of pressure exerted by a standing column of mercury. The higher the column of mercury, the greater is the pressure. Consequently, blood pressure values are expressed in millimetres of mercury (mm Hg). Because the value of the pressure of the blood does not drop to zero between heart beats, blood pressure values are usually taken at two levels of heart activity; 1) at maximal contraction of the heart, specifically the left ventricle and 2) at maximal relaxation of the heart, specifically at maximal volume of the left ventricle as it is filling with blood. The values achieved are referred to as the systolic pressure and the diastolic pressure respectively. By convention, they are written in that order, for example 110/50.

Problems have arisen concerning the methodology of obtaining the true back pressure values, consequently normative or standard values obtained for various age groups differ somewhat. In general, blood pressures, both systolic and diastolic, tend to rise with age from values as low as 67/45 (Moss and Adams, 1965) at birth to mean values of 114/69 for 19-year-old males to 113/66 for 19-year-old females (Richey, 1931). In general, most studies show that females have slightly higher systolic and diastolic pressures during infancy and childhood than do males; during adolescence the pressures become similar, and by age 19 and beyond, the average blood pressure of males at any given age tends to be higher than that of females. Shock's data (1944) obtained from longitudinal studies, reveal a small, temporary reversal in the upward trend of diastolic pressures for both males and females between the ages of 12 and 14½. Earlier maturing boys and girls develop higher systolic and diastolic pressures than do late maturers. Shock (1943) found that systolic pressure reaches a peak before menarche.

Pulse rate (=cardiac rate) is the number of complete beats the heart makes during a given unit of time, usually one minute. Because of the relative ease with which values can be obtained, it has long been used as a functional measure for both physiological and clinical studies. Pulse rate is influenced by many factors relating to both the mental and physical states of the subject involved. Such factors include emotion, posture, exercise, metabolic rate, external and internal temperature, thyroxin levels and so on. Consequently, studies involving pulse rate must be run under very carefully controlled situations. Pulse rates may be measured by counting the number of surges of blood felt in any convenient artery over a given amount of time. More sophisticated measures of pulse rates can be obtained by monitoring the electrical activity associated with the heart; that is, by obtaining a continuous electrocardiogram, (ECG, EKG). Since the pattern of electrical activity repeats for every heart beat, measurements of the time between two identical electrical events between two successive beats will yield an instantaneous cardiac rate value. The instantaneous cardiac rate has value for determining the relationship between other events and the cardiac rate. Measurements of cardiac rate by palpation (touch) require that several pulses be counted; consequently, only an average is obtained, and changes that occur may be missed.

Perhaps the best normative studies, both longitudinal, were obtained by Iliff and Lee (1952) and McCammon (1961). There were slight differences in methodology. Both studies used ECG's as their bases; however, Iliff and Lee's subjects were measured in the morning after completion of basal metabolism tests; that is, the children were quiet, fasting, and relaxed. McCammon's subjects were relaxed, lying quietly, but were not in basal state. In both studies there is a decrease in the pulse rate of both male and female subjects with age. Both studies reveal a sex-related average pulse-rate difference beginning about age 10.5 years (chronological) and apparently continuing throughout life.

Beyond that age, the average pulse rates are higher for females than for males. However, since these longitudinal studies are arranged by chronological age rather than physiological age, the point at which the sex-related differences occur is probably blurred. A physiological age-related study might reveal a more sharp distinction in the onset of this difference.

Cardiac rate changes have begun to be used directly in educational studies. Darley and Katz (1973) used heart rate changes as a measure of anxiety under conditions of test and games conditions. Subjects (20 - fifth-grade boys) were presented with a visual game projected on a screen in front of them which involved certain identification problems. After basal cardiac rates had been established, a pause ensued. Following this, half the subjects were told that the game would continue; the other half were told they were now in a test situation; that is, that their answers would be scored. Cardiac rate increased significantly in the latter group. They conclude that the data demonstrate the usefulness of using cardiac indices for studying test behaviour and anxiety in children.

Angelotti et al. (1973) used heart rate as a measure of reading involvement. Twenty 7th-grade boys were presented with two pieces of reading material; the first, an historical paper; the second, a science fiction short story. Cardiac rates were significantly lower while the subjects were reading science fiction than while they were reading history.

These last two papers may serve as indicators of a beginning trend in education research--the use of physiological indices as a measure of learning experience. Both papers take cognizance of the fact that learning or any learning experience involves not just the mind of the individual, but rather the whole individual. This conceptual approach is at odds with the Western civilization viewpoint of the mind-body dichotomy which has been operant since the time of Aristotle. Both papers may serve as a source of embarrassment to educational systems in that, if conclusions can be drawn, both testing and so-called academic subjects, in this case, history, have become identified in students' minds with anxiety, that is, education as presently practised, generates anxiety rather than learning.

Cardiac rates as measured by electrocardiography were studied by Thompson et al. (1969) in adolescents at rest and at maximal exercise. One hundred and fifty-two subjects, with both sexes represented in approximately equal numbers were investigated. Resting cardiac rates ranged from 80 to 90 per minute. Under conditions of maximal exercise, the cardiac rates ranged from 180 to 220 beats per minute. There were sex-related differences; female adolescents had slightly faster resting rates; they required a shorter time to reach maximal exercise as measured by maximal cardiac rates. Girls were capable of maintaining maximal exercise for a greater length of time than adolescent boys. Finally, girls achieved recovery from maximal exercise sooner than boys.

Haematology is the study of the blood. Blood is a complex fluid consisting in good part of water in which are dissolved various salts, several varieties of small molecules being transported from place to place, and three major groups of plasma proteins. These plasma proteins and their functions are the following: 1) albumins, which have an osmotic function which prevents the complete loss of water from the blood at the capillary level, 2) globulins, some of which are antibodies (the so-called gammaglobulin fraction), and 3) fibrinogen, the protein molecule which under conditions of trauma precipitates out to form clots thereby stopping gross leaks in the cardiovascular system.

Suspended within the fluid portion of the blood are the various blood cells. The vast majority of these are red blood cells (erythrocytes) whose primary function is the transport of oxygen from the respiratory surface to all the body. The remainder of suspended cells are the white blood cells (leucocytes). There are five major types, as determined by their microscopic anatomy and chemical staining reactions: neutrophils, lymphocytes, monocytes, eosinophils and basophils. The leucocyte series seem to be involved primarily in disease prevention. Since different leucocytes have different functions in various diseases, the relative number of leucocytes may vary with disease conditions, thereby providing at least a clue to the type of disease present.

Clinically important measures of blood parameters include total red cells; total white cells; differential numbers of white cells; haematocrit (HCT) or packed cell volume (PCV), and mean corpuscular haemoglobin in the average red cells (MCH). Values of cell numbers are expressed in millions (for erythrocytes) to thousands (for leucocytes) of cells per cubic millimetre of blood. Differential white cell counts are given in the percentage of each type of cell relative to the total number of cells in a given volume. The haematocrit (HCT) is obtained by centrifuging a sample of blood and measuring the length of the column of packed cells relative to the length of the entire column of blood; haematocrit is given in percentages. Values of mean corpuscular haemoglobin are given in micrograms of haemoglobin in the average red cell. Haemoglobin is the protein within cells which carries the oxygen; both a lowered HCT and lowered MCH may indicate an anaemic condition.

Both white and red cell values are higher in infants than in adults. There is a decline in red blood cells not too long after birth; a low point is reached at from 6 weeks to five months past birth. A slow increase in red cell count of about 0.7 million red cells/cubic millimetre of blood is observed in both boys and girls up to the time of puberty. Kasper and Wallerstein (1970) studied red cell values in 129 healthy adolescent boys and girls aged 12 to 17 years. They found a gradual rise in red cell values beginning with puberty and continuing throughout adolescence in males and females. This sex-related differential response of the blood-forming tissue in adolescents yields the differential average red cell values of 5.0 million erythrocytes per cubic millimetre of blood for adult males, and 4.5 million red cells per cubic millimetre of blood for adult females. Kasper and Wallerstein found that haemoglobin values had not yet reached adult values at age 17. The sex-related difference beginning with puberty is associated with increased testosterone levels in males; therefore, it is not that female haematopoietic tissue is incapable of responding, but rather that the stimulus for increased red blood cell production is lacking.

White cell counts reach a high normal average value of 20,000 to 22,000 cells per cubic millimetre sometime during the first 24 hours after birth. Adult values of 7,000 to 10,000 cells are slowly achieved and become reasonably stable about the time of puberty. White blood cell production does not seem to participate in the adolescent growth spurt.

4. Child-Bearing in Adolescence

As has been previously noted, the menarche has been used as a convenient sign-post for determining the point at which sexual maturity is achieved by girls. But if sexual maturity is equated with reproductive capacity, then the menarche is a not very convenient guide. It has been known for some time that there is a period of sterility (of greater or lesser length) following the menarche; that is, there is a length of time following menarche during which conception is not apt to occur. The physiological bases of this period of adolescent sterility have not been clarified, though the following items have been suggested as causes, both singly and in concert, of adolescent post-menarcheal sterility: 1) non-competence of the ovary, i.e., lack of ovulatory activity by the ovary; 2) non-competence of the endocrine system, i.e., while the uterine tissue is capable of responding to the perhaps lower or perhaps the not-yet regulated amounts of the various hormones so that menstruation results, the endocrine system has not yet achieved the level of maturity so that ovulation by the ovary can result; 3) non-competence of the uterine wall, i.e., while the ovarian system and the endocrine system may be competent so that ovulation and subsequent fertilization may occur, the uterine wall may be in such a physiological state that implantation and subsequent development of the embryo in the uterus does not occur. When one considers the entire population of adolescent girls, and the great variability found within any given population for any given physiological parameter, it is easy to suggest that any or all of the above may be operable in any one individual. The list of possible causes of adolescent sterility is not meant to be inclusive; as the physiological bases of reproductive capacity are studied further, more items as known or probable causes of adolescent sterility will most probably be added, and clarification of listed causes will be accomplished.

More to the point of this paper, Talwar (1969) studied the occurrence and duration of adolescent sterility in an Indian population.

The advantage of this study is that in the population studied, consummation of marriage occurs either slightly before or immediately at menarche; thus Talwar was able to measure the interval between the consummation of marriage and birth of the first child of the marriage. Two thousand seven hundred and thirteen subjects participated in the study. Talwar concluded that some degree of adolescent sterility extends to age 19. The percentage of non-fecund (i.e.,sterile) married women was 98 at age 11, 9 at age 18, and essentially 0 at age 19. While intermediate data are missing, a plot of these three data points suggest a linear relationship between age and sterility in married adolescents. That sterility is not 100 per cent at age eleven and decreases steadily should be strong encouragement for any school system to include in its curriculum an adequate sex education program. In the North American culture, where marriage is delayed for several years after menarche, such a sex education program should be started before the menarcheal age.

Studies on obstetric performance by adolescents are scanty. Several recent papers, however, allow trans-national comparisons. Hay and Boyd (1973) studied obstetric performance in adolescent Jamaican primigravidas aged 16 and less; Coates (1970) studied obstetric performance in North American primigravidas aged 14 and younger; and Sternadel et al. (1964) studied births in adolescent Polish mothers aged 13 through 18 years. Hay and Boyd's study involved two hundred twenty-six subjects and compared their performance with other older primigravidas. The adolescent group showed no increase in pre-eclampsia, ante-partum haemorrhage, or ante-partum anaemia over older primigravidas. Post-partum haemorrhage, however, was more common in adolescent primigravidas than in older primigravidas. Low operative delivery rate was associated with a low incidence of foetal distress. They concluded that overall good obstetrical performance by this group of adolescents was probably achieved by good antenatal care.

Coates' study involved comparison of 137 cases of adolescent obstetrical performance in which the mothers were 14 years old or younger with the obstetrical performance of older women. Coates found the following items to be more frequent in the adolescent group: acute toxemia, uterine dysfunction, one-day fever, and an increase of infant cardiovascular system anomalies. These results are somewhat paralleled by the study of Sternadel et al., though caution must be exercised in comparing the two studies. Sternadel et al. analyzed the medical records of one thousand one hundred and eighty-nine 13 through 18-year-old women. These women delivered their children over the thirty-five year period from 1927 through 1962, while the Coates study involved adolescent obstetrical cases in the 1960's. The Sternadel et al. study would be complicated by the development of better obstetrical procedures, the development of antibiotics, and the effects of World War II on some, but not all, of the subjects studied. Sternadel et al. found premature births occurred in 16.1% of all adolescent mothers; and 17.6% of all those mothers 17 or less years of age at the time of delivery. Normal delivery was accomplished in 94% of all cases, but perinatal (infant) mortality was 8.8%. This value of prenatal mortality is age-dependent. Excluding foetal abortions (spontaneous) and still-births, perinatal mortality was 3.3% for 18 year old mothers, but 6.1% for mothers aged 17 or less.

Hay and Boyd's study, when compared with the other two obstetrical studies, would indicate, that on the whole, child-bearing and childbirth is no more difficult or dangerous for adolescents than it is for older women as long as proper antenatal care is provided. The two hundred twenty-six deliveries recorded were all accomplished at the University Hospital, Kingston, Jamaica. To suggest that the Jamaica primigravidas were more mature than their North American counterparts, and therefore more capable of adequate obstetrical performance, would not accord with the fact that the lowest average age of menarche reported by Tanner elsewhere in this paper is found in North America.

In those populations where the primary concern for the health and well-being of the mother and child rather than concern for the potential social stigmatization of mother, child and family, antenatal care is probably initiated early in pregnancy. This early concern should result in good antenatal care, which, as Hay and Boyd suggest, is the cause of the overall good obstetrical performance they observed.

School systems should be as concerned with the occurrence of adolescent pregnancy as they are with the occurrence of adolescent tuberculosis. Early diagnosis leads to a good prognosis in both instances. Pregnancy screening would not be much more difficult nor expensive than screening for tuberculosis (if for no other reason than that only half the school population would be involved). School officials and teachers might foster an attitude of trust and non-condemnation of behaviour so that when adolescent pregnancies do occur, the adolescent mother can begin proper antenatal care as soon after conception as possible.

5. Biorhythmicity of Consciousness(*)

Vygotsky employed the term consciousness in the sense of the highest level of abstraction and generalization, through which a person can become master of his own world. There is another possible meaning among others (Ryle, 1943), which denotes the general level of perceptual awareness. It is this meaning of consciousness, and its relevance to teaching and curriculum development and implementation, that is the subject of this review.

Quite often it is assumed a person's general level of awareness is relatively stable, with differences only between the states of sleep and wakefulness. There is, however, considerable evidence that the quantitative and qualitative aspects of sleep and wakefulness have regular and more or less periodic fluctuations which influence the level of consciousness. Certain functions which occur with the periodicity of approximately a day, more specifically defined as having a reoccurrence pattern range of every 20 to 28 hours, are labelled circadian (circa diem, about a day). Ultradian cyclic changes are those that have a period of less than a day, while those that recur less frequently, with a periodicity of more than one day, are termed infradian. The last two terms have become common usage, even though it seems they should be logically reversed.

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* Dr. Roger Broughton of the University of Ottawa supplied much of the material which entered into this review.

These rhythms influence consciousness both in sleep and wakefulness. Sleep, reoccurring with a frequency of once a day for most adults, is an excellent example of a biological function that has a circadian distribution. Superimposed on this are ultradian variations of two types of sleep: NREM (non-rapid eye movement), and REM (rapid eye movement), these states being thus divided according to the presence or absence of conjugate eye movements.

NREM sleep has four stages, arbitrarily divided according to the predominant brain wave activity in a specified time epoch, usually of one minute duration. In general, as a sleeping person descends through the stages from 1 to 4, there is a progressive slowing and increase in amplitude of brain waves, decreasing muscle tone, slowing of heart rate and respiration, and a relative bodily quiet, such that stages 3 and 4 are often labelled slow-wave sleep.

The other state of sleep, REM, has a basically much more active character to it. There are the conjugate rapid eye movements, often associated with the type of dream the person is having; the brain wave activity as measured by an electro-encephalogram is predominantly low-voltage mixed frequencies; there is an obvious muscular hypotonia, in which the body is in a state of apparent paralysis, yet still has certain motor phenomena such as movements of the extremities and facial areas; there are penile erections in males, and, in females, clitoridean erections and increased vaginal blood flow; finally, increase in autonomic rate and variability is evident.

These two states of sleep have a very stable alteration period for a given person or age group (Globus, 1970; Lubin et al., 1973). Jouvet (1969) in fact suggested the presence of an underlying neurochemical clock which guides this periodicity. The NREM/REM cycle, usually measured as the period from the beginning of one REM period to the next, is of approximately 40 to 45 minutes duration in the newborn and gradually lengthens to an average 90 minutes in the adult (Roffwarg et al., 1966).

This 90 minute cycle (see Figure 3) apparently is the most dominant ultradian rhythm in man (there are other ultradian rhythms). Yet it itself is influenced by circadian periodicity. For example, in young adults, NREM is maximally present in the first third of the night, and seems to peak every 24 hours at 1 to 3 a.m., while REM increases in length until it maximizes every night in the later stages of the night. Indeed, all stages of sleep and also wakefulness peak statistically at a particular time of day (Crowley et al., 1972).

The level of consciousness in sleep appears to vary with the two states. There is a general conclusion that REM is associated with dreaming, that is, the vivid sequences of vision and often sound that

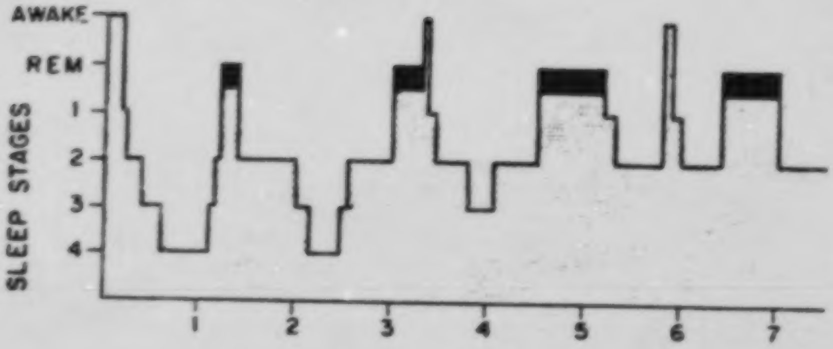

Figure 3. Histogram of Typical Sleep in Young Adults.

The ultradian periodicity of the NREM/REM alternations occur approximately every 90 minutes. Note that NREM is maximal in the first third of the night, while REM has its greatest percentage in the latter third.

are commonly associated with the term. NREM supposedly does not have these hallucinatory aspects, but seems to be more thought-like. However, certain authors (Foulkes, 1962, 1967; Goodenough et al., 1965) have now shown that NREM also has dreams which are not of a thought-like nature.

Indications are that, during sleep, a type of awareness of the outside world exists. Meaningful sleep dialogue can occur (Broughton & Gastaut, 1973). External stimuli have been incorporated into dream contents (Dement & Wolpert, 1958; Berger, 1963). Nevertheless, these facts can not be considered a true awareness of the environment.

The existence of the varying states of consciousness during sleep may be of no direct relevance to education per se. It has, however, been more extensively documented than the effects of biorhythmicity in wakefulness, and acts as a type of backdrop on which the waxing and waning of waking biological functions and their effects can be painted (Ephron & Carrington, 1970).

Kleitman (1963, 1969) sees the NREM/REM cyclicity as a continuation into the sleep state of a very fundamental and phylogenetically older biorhythm. It ranges from fluctuations in spontaneous gastric secretions to the fantasy life of daydreams. This periodicity is called the basic rest-activity cycle (BRAC), and is essentially an ultradian rhythm.

The BRAC ultradian rhythm is obvious even on a superficial daily level. On an average day, a hypothetical worker may rise at 7:30 a.m., begin work at 9, have a coffee break at 10:30, lunch at noon, return to work at 1:30, coffee at 3, etc. Even if this social pattern is not adhered to, it appears that the inner beat goes on for many functions, and is reflected in the quality of activity.

Wada (1922), even before the discovery of the NREM/REM cycle, had reported 90 to 100 minute recurring gastric constrictions in wakefulness. This has since been confirmed by Hiatt & Kripke (personal communication to R. Broughton, 1974). Friedman and Fisher (1967) studying persons with manifest oral drive characteristics, unearthed an oral BRAC periodicity in waking man. These people tended to eat, drink or smoke with a cyclical pattern of approximately 96 minutes. This same cyclic oral behaviour was replicated with schizophrenics (Friedman, 1968), while obese people had a shorter oral cyclicity, the shortness of the cycle being highly correlated with the degree of obesity (Friedman, 1972). Other studies on drinking and/or feeding intake similarly reinforced the concept of an oral, cyclic pattern of approximately 90 minutes (Oswald et al., 1970; Kripke, 1972; Lowy, personal communication).

Other functions, both biological and performance, have been shown to reflect this same BRAC periodicity. Errors in vigilance tasks were shown to peak in 90 to 100 minute fluctuations (Globus, 1972; Orr et al., 1973). Orr et al. also noted that heart rate fluctuated in unison with vigilance performance, and that the amplitute of modulation of both increased with the combined fatigue and stress of prolonged testing. In addition, it appears that small changes in body temperature are correlative with the changes in heart rate.

The cyclical variations in neurochemical and neuroendocrine substances, which would of course influence the level of consciousness, have been well reviewed by R. Broughton (1973), and is somewhat too technical to be included in this review.

What is interesting is that some studies have shown that the phase relationships of ultradian fluctuations correlate with the preceding or subsequent REM cycles in sleep, suggesting that NREM/REM periods are indeed extensions of the basic rest-activity cycle into sleep (Destrooper & Broughton, 1969; Globus, 1972).

Othmer et al. (1972) discovered that REMs, and decrease in muscle tone, occurred every 90 minutes even with awake subjects, and that the subjects reported daydreaming at the same time. This remarkable rhythm of fantasy daydreaming was replicated by Kripke & Sonneschein (1973). Moreover, REM during daytime naps (Globus, 1966) and narcoleptic sleep attacks also occur in the same basic rhythm with nocturnal REM.

There is growing evidence, then, that the rest-activity dimensions of Kleitman's BRAC are part of a 24 hour cyclical rhythm (see Figure 4), and that levels of awareness, perception, performance, fantasy, certain biological function and undoubtedly many more aspects of daily life are strongly influenced by BRAC.

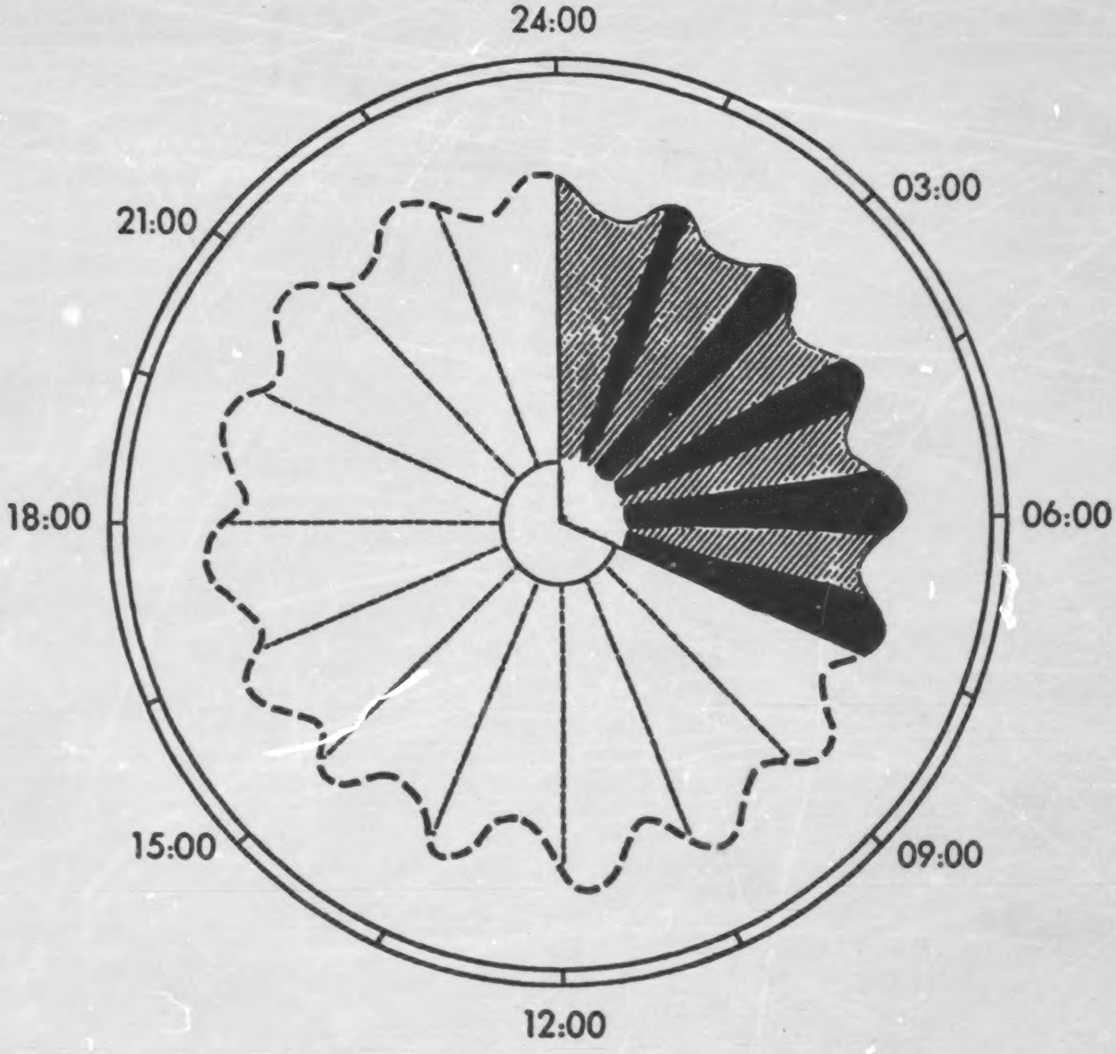

Figure 4. Ninety Minute Alternations of the Basic Rest-Activity Cycle, (BRAC).

These rhythmical fluctuations are especially well documented for sleep, in which a typical person alternates between NREM (hatched) and REM (black). During the day, there is a continuing rising and falling of consciousness, such that high activity peaks occur approximately every 90 minutes, in phase with nocturnal REM periods.

The 24 hour circadian rhythms also influence nearly all types of performance and bodily functions, each seeming to have different peaks and troughs at different times of the day. Kleitman (1939, 1963) noted that, on a series of different tasks, both performance and oral temperature followed a similar circadian rhythm, lowest in the early morning, improving (or rising) before noon, peaking in the afternoon, and then tapering, with temperature peaking later in the afternoon, about 6 p.m. There seems to be a close relationship between test performance and temperature. Blake (1967) found the maximum levels to be considerably later than Kleitman's results, the highest point being around 9 p.m.

Memory functions, on the other hand, appear to function best in the morning, when body temperature is low (Blake, 1967; Baddeley et al., 1970; Hockey et al., 1972). Another very common phenomenon is the so-called "post-lunch dip", a decrease in performance and awareness which appears around 1 p.m., independent of both food intake and body temperature, even though food or drink satiation may normally play some role. The more advanced cultures handle this by having a siesta.

Viewing this post-lunch stage in the context of an entire circadian rhythm reveals a bi-phasic circadian pattern. A series of studies (Browne, 1949; Bjerner et al., 1955; Aschoff et al., 1972; Fort & Mills, 1972) have shown that tasks as varied as tapping speed, reasoning capacity, logging errors in a gas works, and delays by telephone switchboard operators in answering a call, had their lowest level of vigilance and poorest results around 1 to 3 a.m. Thus there may be two opposing nadirs of performance and vigilance.

It appears that all body functions fluctuate throughout the day, and that we are different people at different times of the day (Luce, 1971). There is, in addition, an amazing complexity and interfacing of different biorhythms. Circadian rhythms (Figure 5) may be summarized as having two dips of consciousness, in the early morning and early afternoon. There are also two zenith points of functioning: memory in the morning, and a later afternoon or evening peak for apparently different functions. These are superimposed on the ultradian rhythms of Figure 4.

It is briefly noted that infradian rhythms play some additional role. Women undergo certain personality and biological changes associated with their menstrual period (Hartmann, 1966). There seems to be a weekly fluctuation, perhaps best observed in the TGIF syndrome (well known among teachers) which may be influenced by environmental demands. There may also be seasonal, yearly, and life-time changes. Finally, much of the above is representative of the average population. There are always individuals who are different, such as the night owls, who perform best at night.

These biorhythmical patterns appear to be guided by a natural biological clock, so that, even when external time cues are eliminated and a person is left to "free-run", the sleep-wake cycle has an innate frequency of 24.5 to 25.5 hours. However, social mores often impose,

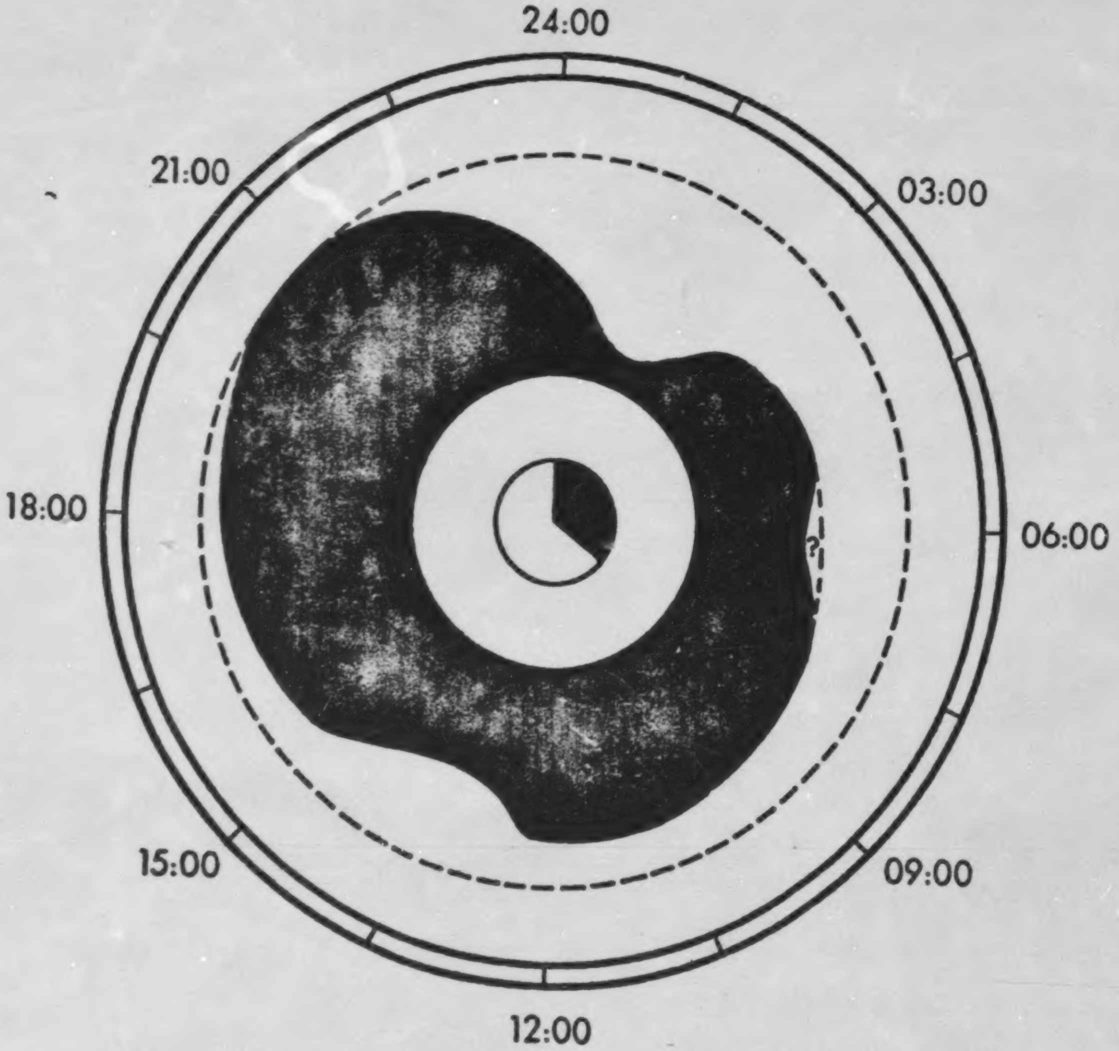

Figure 5. Twenty-Four Hour Circadian Alternations Superimposed on the BRAC.

Consciousness and performance are at their highest around 19-21 hours, then decreasing gradually to the marked dip at 1-3 a.m. There is a second possible nadir at 6 a.m., followed by a gradual increase in the morning, which is temporarily halted by the post-lunch dip. The increase continues, reading its maximum levels in the late afternoon or early evening. Not illustrated is the morning peak for memory functions.

through time-cues, a refinement of many circadian rhythms so that they have an exact 24 hour cyclicity.

What are the applications of the knowledge of biorhythmicity to adolescent education? The problem is precisely that this is not known, nor is much research being done to unveil these important mysteries. It is obvious that cyclical variations do play an important role in performance and awareness. Whenever the natural clock is deviated from, deterioration of some sort occurs. On a very general level, the effects of jet-lag and shift-work are well-documented (see Colquhoun, 1972). A study on sleep pattern, performance and mood (Taub & Berger, 1973) noted that changes in length or timing of sleep produced detrimental results which seemed to be due not to changes in the actual sleep parameters, but to the disruption of an established circadian rhythm of sleep and wakefulness. Mere phase shifts in the sleep-wake cycle have resulted in changes in sleep stage patterns (Berger et al., 1971; Webb et al., 1971); in the cyclicity of body temperature and heart rate (Hauty & Adams, 1966; Klein et al., 1971); and in neuroendocrine processes (Weitzmann et al., 1968).

Stress and personal conflicts have been known to upset, or desynchronize, the biological clock. Orr et al. (1973) had observed that stress increased the ultradian variations in performance by producing cyclical dips.

Certain concepts can be accepted as a starting point. Consciousness or awareness is not static, although its periodicity is relatively stable. There are both inter and intra-individual differences, with quantitative and qualitative variations, leading to the observation that one cannot demand a rigid consistency of performance or awareness.

Theoretically, it seems that the awareness level would be dependent on the harmonics of synchronization of the many biorhythms, those known and those yet not known. There is ample room for research here.

More concrete applications may be these. Students (and teachers) may be taught to be aware of their own inherent body rhythms, and how to use and control them. The mere acceptance of the effects of normal periodicity may in itself be of tremendous value for peace of mind. A person who can accept his lows as well as his highs as part of his ordinary life-rhythm will be better able to cope with them, and will have the compassion and/or necessary firmness to understand and deal with the cyclicity of others. In this context, teachers should be capable of recognizing the effects of biorhythm desynchronization.

This review has underscored the necessity of knowledge, and application of the knowledge, of biorhythmicity for all levels. Adolescence, with its multiple biological, educational and social changes, seems to be a period of biorhythm transitions, influencing and influenced by the environment. It would thus be a crucial period in the infradian life cycle. Even though little research has been done in this area, it appears that it is of the utmost importance for understanding, educating and interacting with students of this age group.

6. Summary and Educational Implications

i. Summary

Adolescent physiology is in its infancy. This state of affairs stems in good part from an only-rather-recent appreciation that adolescence is a recognizable and distinct period in the life history of the human organism. The vast majority of studies in adolescent physiology have been concerned with growth as evidenced by increases in height and weight. Secondarily, these studies have been concerned with the acquisition of reproductive competence (sexual maturity). The great preponderance of studies in growth are probably reflections of the relative ease of obtaining such data. All one needs is a tape measure, a weight scale, and a sufficient number of adolescent children. While differences in methodology are rarely a problem (e.g., standing height vs., sitting height) the growing emphasis on distinguishing physiological age from chronological age may well negate the value of earlier studies.

Physiological age, as determined by sexual maturity of Tanner standards, is more representative of the average real state of affairs in adolescents. As Tanner and others have so pointedly demonstrated, averaging physiological parameters by chronological age may well mask not only real physiological events that occur in all adolescents, but may also mask the intensity and the time of onset of these events.

The study of the interrelationships between physiological events is just beginning. Relationships have been established at least for the following:

1. Skeletal maturity and the onset of peak height velocity;
2. Weight and the onset of peak height velocity;
3. Peak height velocity and the age at menarche;
4. Development of secondary sexual characteristics and peak height velocity;
5. Onset of menarche and the acquisition of reproductive competence;
6. Onset of puberty and the acquisition and re-establishment of a new level of operation of the hypothalamic pituitary gland-gonadal axis;
7. Onset of puberty and the acquisition of adult competence in metabolic, respiratory, and circulatory functions.

These are only some examples of established relationships; obviously, some of the relationships are better established than others. The obtaining of usable data for any physiological parameter will depend in good part on the reasonableness of the methodology used to obtain them. It has also been demonstrated in this chapter that the methodology of the analysis of data may also be subject to some disagreement.

The large number of studies on the acquisition of reproductive competence is probably due in part to the fascination which the sexual reproduction process holds for the human mind, and also in part due to the landmark nature of the acquisition of this level of human existence, such a landmark surpassed in its importance only by conception, birth and death. In any event, the acquisition of reproductive potential is the critical event of adolescence, and therefore it behooves all those who are associated with adolescence to be cognizant with this fact. Some may even suggest that the basis of education of the adolescents should be based on a "rite of passage" concept, in that adolescents are passing from a condition of no reproductive capacity to a condition of full reproductive capacity.

The physiological data presented in the earlier parts of this chapter are characterized by several obvious items that are or should be of interest to educators and all others who are associated with the education of adolescents. First, average individual physiological events show a wide range in response. For example, while the average chronological age of menarche is approximately 13 years, the range of years over which menarche occurs is 10 through 16 chronological years. Second, the relationships between physiological events show a wide range of response. Consequently, while general trends can be perceived (e.g., menarche occurs during the decrease phase of the adolescent growth spurt), hard and fast rules, or normative values, are not easily seen. Third, normative values, or physiological standards for adolescents generally are not very helpful, either in a predictive sense or in a clinical sense. This is so for many reasons: the methogology involved may be in question; chronological ages are more apt to be employed than physiological ages; expectations that data obtained from one subset of the adolescent population apply to the entire worldwide adolescent population have been shown to be unfounded; lack of continuing longitudinal studies obscures trend changes in adolescent populations. Fourth, there are few studies that interrelate physiological parameters with learning parameters, if indeed, any such interrelations exist. And fifth, secular trends in physiological events have occurred, and are still occurring.

ii. Implication

A brief survey of the physiology of adolescents reveals that the area is relatively unexplored, except in a very few areas such as growth in height, growth in weight, and the achievement of sexual maturity. Secular changes in these items have been observed for at least 150 years. Average values for these adolescent physiological events are presented, as are the time ranges over which these phenomena occur. The various physiological events are more or less tightly or loosely linked to each other. Linkage of physiological events to acquisition of intellectual powers in adolescents has not been investigated; or if it has, has not been reported. From the rather sketchy data on adolescent physiology, the following recommendations can be made:

1. Boards of Education should establish Physiological Services whose function would be the monitoring of physiological parameters, especially those related to learning. Such monitoring

will require a staff physiologist who can sift the yet-to-be published literature for studies that relate physiological changes to the educational process. Present indications are that these studies will become more prevalent in years to come.

2. Curriculum innovations should be made which will show the adolescent boy or girl the relationship between his or her present physiological life-style, and both, what has preceded it and what will follow it. Those who devise such curricula must be aware that i) adolescence is a time of substantial change in physiology and psychology and ii) that in the biological sense at least, each individual adolescent child is at any one instant a wholly integrated human person; that is, that the individual adolescent is operating as an efficient biological machine within the limits of his/her evolutionary and environmental background, is accomplishing those biological events that it should be, and is, furthermore accomplishing them in an integrated manner. If this statement were not true, then no adolescent child would survive to maturity.

3. Above all, each adolescent child must be treated as an individual, which he or she most assuredly is. The number of physiological events associated with adolescence, the great range in time over which these events occur, the great variation in linkage between the multitude of physiological events in adolescents establishes that at the biological level at

least, each adolescent child is unique, and uniquely so at each instant of his or her life.

4. If physiologically or maturely homogenious classroom populations are desired, classroom grouping by chronological age is the easiest method for obtaining this homogeneity.

5. To offset the trauma and hazard of old methods of measuring organismic age, Forbes (1968) recommends the use of a technical measuring body content through the use of scintillation counter that measures the naturally occurring "Radioscope potassium - 40" in the body. Since fatty tissue does not contain potassium, this measurement provides an estimate of the proportions of fat and lean tissue in the body. Preliminary laboratory tests, Forbes reports, "confirm trends in body composition". This method, which is non-traumatic and not hazardous, may give an index which is as reliable as the conventional and hazardous X-ray techniques in use today.

6. Special care must be made when grouping adolescents in physical education classes. Pitting physically immature adolescents in contact sports is dangerous. One should be cautious not to impose severe limits on the immature adolescent because of the possible distortion of self-image that such limitation may create.

7. All teachers should receive appropriate training in human physiology. The following items concerning adolescent

physiology must be stressed: i) the acquisition of physical and sexual maturity as the basis of adolescence, ii) the changes involved in the acquisition of physical and sexual maturity, and iii) the great variability in the timing of adolescence.

8. All children should receive similar appropriate training in human physiology with the stress upon the same items as discussed in number 7 above.

9. Above all, the uniqueness of every individual must be made apparent to all children, their parents, and those who determine the thrust and direction of the educational program.

10. The dissemination of information on these physiological phenomena, as important as they are, should not be considered sufficient in and of themselves. On a day-to-day basis the adolescent will need opportunities to try out new ideas as plausible hypotheses about himself. He will need opportunities for interaction on a demand basis with highly qualified adults.

11. The awareness of rhythmical variations in performance and consciousness, at least for the majority of people, is of relevance in the daily application of the curriculum. Early morning and late afternoon peaks should be utilized for their respective purposes. The "post-lunch dip" should be avoided, as a rule, as a time of educational importance. There may also be other areas of relevance here which are not yet known.

3 Early Adolescent Cognitive Functioning and Intellectual Growth

1. Introduction

Historically, studies of adolescence have primarily focussed on a number of standard themes: adolescent identity crises, expressions of hedonism, strivings for independence; sexual discovery, and idealism-romanticism (Kohlberg and Gilligan, 1972). All of these themes were subordinate to the major standard theme of adolescent marginality, adolescence as a period of time somewhere between childhood and adulthood, with the adolescent caught in crosscurrents produced by a once seeing himself as a child and as an adult. Unfortunately, general acceptance of this viewpoint prevented serious scientific study and promoted a patent disregard of adolescence as a developmentally vital and important stage in its own right. Few developmental theorists since G. Stanley Hall (1916) have attended to the stage of adolescence as worthy of legitimate theoretical elaboration and research. Only recently have the massive contributions of Piaget (Inhelder and Piaget, 1958) and Eriksen (1963) sparked a significant rekindling of interest in this developmental epoch.

Where research was pursued, it concentrated on the social-emotional "sturm und drang" in adolescent behaviour and development, emphasizing adolescent sexual, social, and identity problems, paying essentially none or merely minimal attention to cognitive functioning and development. Yet, remarkable and profound cognitive changes occur during adolescence, camouflaged by the more dramatic social-emotional transformations, but closely intertwined with and possibly determining them (Elkind, 1968).

Early adolescence, principally the age period between 12 and 16, is witness to major cognitive changes, elaborations and consolidation in cognitive processes and intellectual capacity. The present section of this document will endeavour to present a broadly descriptive profile of cognitive functioning and intellectual capacities during early adolescence. The objective is naturally constrained by limitations of space, sacrificing in-depth explanation to a descriptive summary review of currently available data encompassing the ever-expanding area of early adolescent cognitive development and functioning. Selective emphasis of prominent cognitive developmental issues and phenomena will supersede the sensational and obscure. Empirically supported observations rather than speculative contentions will serve as a criterion for inclusion of particular discussion and exclusion of other. Where possible, an atheoretical viewpoint will be maintained since the major thrust is to identify and articulate early adolescent cognitive abilities and growth rather than to explain differences or elucidate causal factors.

Basic issues in cognitive psychology and human cognitive development over the entire life span will be included where relevant, but their treatment will necessarily be incomplete and dictated by the limited focus on early adolescence. In effect, a portrait of early adolescent cognitive functioning and development will be painted with a narrow brush. If human cognitive development and intellectual growth can be likened to a film, complete with plot, a beginning and an end, our presentation will consist of an edited strip. The obvious strength of this approach is that it brings into relief a critical developmental span which may be obscured within a broader portrait of development. The obvious limitation is less of the richness and tangle so characteristic of the full course of development.

"Cognition", "cognitive functioning", and "cognitive processes" are terminologically similar yet vague concepts. Their definitional variants seem to depend on who used the terms and for what purposes. To facilitate a modicum of meaningfulness, Berlyne's (1966) broad definition of cognitive processes is deemed appropriate since it accounts, in some part or other, for many of the specific topics entertained throughout the remainder of this section. He sees "cognitive processes" as embodying all elementary and interactive processes whereby human knowledge is acquired and maintained, principally the processes of attention and perception, memory, problem solving and thought. To a limited degree, the present review will describe the developmental nature and role of these processes during adolescence.

Early adolescent cognitive development and intellectual functioning will be triangulated by analyses reflecting the approaches of three major research and theoretical traditions. One such tradition is represented by the monumental psychometric efforts of the mental test movement (Bayley, 1970). Another by the Genevan school, which emphasizes the qualitative and dynamic developmental intricacies and changes in dimensions of thought (Piaget, 1950; Inhelder and Piaget, 1958). And a third point of departure is represented by the recent, but prolific, outpouring of research into individual differences in cognitive processes, the topic of "cognitive styles" (Kagan and Kegan, 1970).

The psychometricians' contributions to our understanding of adolescent cognitive growth and functioning was purely a byproduct of their concern for test development and validation. Substantive issues in cognitive processes were subordinate to measurement methodology and rigour. Creating and refining indicators of mental ability and intellectual growth: the standardized IQ test, tests of primary mental abilities, and the like, the psychometricians left an artifactual legacy of statistical, normative describers of adolescent thinking capacity and intellectual growth. In addition to quantitative description of intellectual growth spanning human development including the adolescent years, they have gathered data bearing on the relative constancy of intellectual capacities as a function of age, the differentiation of mental abilities, the impact of sex and other demographic characteristics on intellectual development, as well as cross-generational, cross-cultural differences in intelligence. The heuristic and practical import of their observations for understanding adolescent cognitive capacities and for predicting achievement and behaviour will be subject to review.

Even though one recognizes the importance of the psychometric view of intellectual development and capacity, a study of the contributions of the psychometricians shows that their methodological-quantitative focus fails to capture the profound qualitative transformations occurring in thought during early adolescence. What static measurement of intellectual capacity obscured was the uniquely adolescent emergence of formal operational thought (Piaget, 1950). Working within the context of a wide-ranging theory of cognitive development and utilizing data gathered for over a half-century, the Genevan school's view of adolescent cognitive functioning attacks questions of growth in abstract formulations and logical thinking, evolvement of thought about one's thinking, capacity to divorce a subjective view of phenomena from objective views, and the expansion of adolescent perceptions of time and space. A rich tapestry of abstract thinking and conceptualizing is woven during the adolescent years which sets the stage for mature adult cognition.

An appreciation of both the quantitative and the qualitative approaches is necessary to structure a whole and valid profile of adolescent cognitive functioning (Elkind, 1968; McCandless, 1970). Where the quantitative orientation is decidedly psychometric, directed toward statistical descriptors of adolescent learning capacities and mental organization, the qualitative approach is oriented toward exposing substantive transformations in thought, the dynamics of cognition. Where the quantitative view emphasizes IQ, mental abilities, and other quantifiable and static entities, the qualitative view presents data circumscribing the flux and process characteristics of thought. Where the former controls motivational, perceptual and other variations to purify its measures of ability, the latter attempts to synthesize and stress their contribution to thought processes. Where the quantitative view is centring on what Cattell (1941) and Hern (1968) refer to as "crystallized intelligence", which seems to be functionally related to environmental arrangements in children's learning, or due to formal educational intervention, the qualitative orientation emphasizes "fluid intelligence", cognitive functioning which seems to develop with minimal cultural intervention. Where the psychometricians' importance in our understanding of adolescent cognitive functioning seems to have reached a saturation point, or at best, a plateau, the influence of the cognitive-developmentalist is of increasing importance as evidenced by the growing numbers of students of child development attracted to research in the Genevan school mold.

While both the quantitative and qualitative approach to study of adolescent cognitive functioning have sought broad, normative description of the substance and development of thought, they neglect to deal with individual differences in thinking and problem solving. A small but vocal group of cognitive psychologists have attached themselves to research designed to identify and elaborate a variety of "styles" whereby individuals process information (Messick, 1970). De-emphasizing cognitive abilities, though acknowledging their importance in cognition, they give greater weight to individual variations in "the manner and form of cognition" (Kegan, 1971). Their emphasis serves as a bridge between the behavioural dimensions of cognition and motivation, adding substantially to our understanding of cognitive functioning. Since the past decade has seen a tremendous upsurge in the identification and elaboration of many cognitive styles, many lacking significant replicatory verification, we will limit our discussion to two of the more prominently researched and validated individual differences in information-processing, reflectivity-impulsivity and field dependence-independence.

2. Quantitative Aspects of Cognitive Development During Early Adolescence

i. Basic Structural Views of Intelligence

Within the intricate matrix of human development, intelligence serves as an influential mediator, interacting in complex ways with other developmental factors to facilitate, condition, and modify patterns of developmental organization and change (McCandless and Evans, 1973). Intelligence varies in definition from the patently operational "intelligence is what intelligence tests measure", to the sublime "...intellectual capacities based on central processes hierarchically arranged within the intrinsic portions of the cerebrum...(processes) approximately analogous to the strategies for information-processing and action with which electronic computers are programmed" (Hunt, 1961). A definition suitable for discussion of adolescent intellectual functioning would identify intelligence as a learning aptitude closely allied with abilities to formulate abstract higher order concepts and to solve problems.

A number of basic structural views of intelligence have been formulated over the past half-century principally by psychometricians interested in the creation and development of tests for mental ability. Where some, such as Spearman (1923), consider intelligence a general and unitary capacity, others describe the structure of intelligence as a composite of many different abilities (Thurstone, 1938), while still another group considers intelligence as that which is limited by the number of tests constructed to measure discrete mental skills sampled from the vast pool of specific human abilities (Guilford, 1966; Thomson, 1952).

Spearman's (1923) theory of intellectual structure is based on a personally developed factor analysis of the then available mental test data. According to his observations, relationships between various measures of mental ability can be accounted for in terms of a "general intelligence" factor which he labels factor g. However, performance on any given task is not entirely a function of g, but involves additional factors. Given, say, a mathematical reasoning task, performance would be determined by the influence of $g - s_1$, while performance on a verbal reasoning task would be determined by the influence of $g - s_2$. Correlation between both tests can be attributed to the common influence of the g factor, while absence of a perfect correlation is accounted for in terms of the independent and unrelated s factors specific to each task.

Reacting to what he considered oversimplification in citing intelligence as a unitary capacity, Thurstone (1938) formulated a multifactor description of intellectual structure based on his factor analytic procedure which identified seven primary mental abilities: number, word fluency, verbal reasoning, memory,reasoning, spatial reasoning, and perceptual speed. He devised tests which ostensibly measured variability in each factor. These tests are known as the Thurstone Primary Mental Abilities Tests (PMA). They demonstrate varying degrees of relationship among each other, unintentionally supporting the operation of a general intelligence factor, yet presence of somewhat higher correlations among different subsets of these seven tests indicates support for a group factor theory.

Finally, the sampling conception of intelligence is compatible with data presented in support of the other views. However, rather than proposing a distinct and limited array of factors accounting for test performance, this position would equate intelligence to all specific abilities reflected in any given test. It maintains that group factors are artificial, fictional constructs of intellectual structure, created as an explanation for the common testing artifact of overlap in particular discrete mental abilities measured by various instruments. A logical conclusion of this approach, evident currently in the work of Guilford (1966) is the unimpeded generation of as many mental abilities as there are tests which overlap in their sampling of specific abilities.

These three positions have implications for the interpretation of empirical data gathered to assess the developmental regularities and variations in intellectual capacities. They were necessarily reviewed to provide a sound framework for understanding the quantitative dimensions of adolescent cognitive functioning and development.

ii. Review of Methodology in Intelligence Testing

Since the majority of descriptive studies reviewed in the following sections rely on measured intelligence as a principal dependent variable and descriptor of adolescent cognitive capacity, a brief review of methodology in intelligence testing is indicated.

The chief dilemma posed in drawing general conclusions about the course of intellectual development, differentiation of mental ability as well as IQ constancy,is the extraneous impact of differences in measurement dictated by the test-taking abilities of children and adolescents. While tests of mental ability in childhood are individually administered and less likely to demand verbal performance, the adolescent's ability to inhibit distractability, use a pencil, and respond to verbal instructions justifies the use of group intelligence testing as a convenient and economical means of gaining evidence into his relative intellectual status. Quite obviously, the adolescent with reading problems or who does not speak the language of the test well, will do very poorly. In addition, particular personality features may interfere with a valid interpretation of intellectual capacity based on test results. For example, Yamamoto and Davis (1966) tested approximately 500 students in fourth, seventh, tenth, and twelfth-grades at a large suburban American midwestern school on the *Task Anxiety Scale for Children* (Hill and Sarason, 1966) and the *Kuhlmann-Anderson Group Test of Intelligence*. Overall, the intelligence test scores favoured the low anxious group by 8.0 points, while at the twelfth-grade level the low anxious group outscored the high anxious group by 16.4 points. The authors speculated that the stronger differences in the twelfth-grade reflect the deleterious effect of anticipating graduation and college entrance. Measures of motivation, coupled with intelligence scores, have also led to more efficient prediction of achievement among adolescent groups (Holtzman and Brown, 1968; Khan, 1969).

Factors complicating valid interpretation of intellectual growth curves include between-test variations of test-item content, the use of differential measurement units, test discriminatility, as well as the often limited ceiling of different intelligence tests. These difficulties are aggravated by the distinctive construction of tests administered to varying age groups. Before intellectual growth curves can be described using these data, they must be transposed into comparable units, a procedure fraught with no small perils for interpretation (Bayley, 1955).

The interested reader can judge the diversity of intelligence test types and their different versions by referral to the Sixth Mental Measurement Yearbook (Buros, 1965) which reviews over a 100 different intelligence measuring instruments. The classification is age-graded and typed according to function. Recently Johnson and Bommarito (1971) produced a like-minded review entitled Tests and Measurement in Child Development: A Handbook, which provides an excellent coverage of more contemporaneous attainments in this area of personality measurement.

iii. Rates of Intellectual Growth During Adolescence

Age trends in intellectual growth have consumed a substantial proportion of the mental test movement's energies. While the psychometrician's principal emphasis dictated a concern with intellectual growth rates over the entire developmental span, of necessity, findings bearing on developments during late childhood and early adolescence were generated. In general, the evidence supports the almost axiomatic expectation that intelligence increases through childhood and early adolescence, with older children, on the average, more intellectually capable than younger.

Two major methodological approaches peculiar to developmental studies have generated data useful in mapping the course of intellectual growth. While their overall observations are generally similar, idiosyncratic methodological differences yield specific and distinct conclusions regarding the course of mental growth.

The longitudinal approach utilizes periodic sampling and testing of the same group of subjects over a given interval of time. The epitome of this approach is represented by the California Growth Studies (Bayley, 1951) which charted intellectual development over the life span. Bayley (1955) maintained continuous contact with subjects from birth through middle-age, noting that intelligence increased through 26 years of age, when it levelled off and remained constant through age 36, the terminal age for the purposes of her study. More specifically relevant to our concern with adolescence, Bayley (1949) points out that intellectual growth during late childhood and early adolescence is negatively accelerated, reflected by relatively smaller increments in intellectual growth with each passing year. McCandless (1967) reviewing the literature charting age-trends in intellectual growth also notes that the pattern of growth following approximately 10½ years of age is characterized by a progressively slower rate. While some investigators report a slight reversal in the rate of negative acceleration during the preadolescent period (Freeman and Flory, 1937; Terman and Merrill, 1937; Wechsler, 1950), and make an attempt to relate it to the occurrence of the physical growth spurt, intellectual growth appears to be continuous and even rather than sporadic and discontinuous.

Cross-sectional cohort studies of intellectual growth are typified by the research of Jones and Conrad (1933), who administered the Army Alpha Intelligence Test to 1,191 subjects ranging in age from 10 to 59. Their results revealed a rapid increase in mental growth through age sixteen, followed by a considerable retrenchment in growth rate. At twenty-one, a downward trend in the rate of growth was established. Shock (1951) in a similar study has generally validated their findings.

Zubek and Solberg (1954) contend that adolescence represents a period of peak efficiency for most mental functioning. Test of intelligence as well as achievement and aptitude tests which require speed, concentration and the maintenance of attention are ideally suited for this age group. Performance on such tests shows a rapid deterioration thereafter. Power tests show least deterioration in performance and do occasionally demonstrate increased proficiency with age, particularly tests of vocabulary and general information.

More recently, Schaie and Strother (1968) have levelled a persuasive argument critical of the substantive observations regarding intellectual growth generated by a cross-sectional cohort method, typified by the Jones and Conrad (1933) study. They suggest that numerous uncontrolled factors, such as generational differences in educational attainment and other socio-historical variations, provide an invalid description of cognitive growth. In support of their argument, Schaie and Strother selected a stratified random sample of 50 subjects from every fifth-year level between the ages of 20 and 70. Each subsample was administered both a test of Primary Mental Abilities (PMA) and a Test of Behavioral Rigidity separated by a seven-year interval. Analyzing the results by way of a cross-sectional approach and projecting curves of intellectual functioning using the seven-year longitudinal data, they note marked discrepancies in the course of mental growth generated by these two approaches. Overall, the curve for individual longitudinal growth remained steady, increased for a longer span of time, and fell less sharply than the curve based on cross-sectional cohort comparisons.

While their results were gathered using a sample beyond the age limits describing adolescence, a general implication would be that these differential methodological approaches applied to adolescent populations such as in the California Growth Studies and the Jones and Conrad cross-sectional study present somewhat different views of adolescent cognitive growth.

Green (1969) conducted an essentially similar research evaluation of the differential intellectual growth curves generated by the two approaches using Puerto Rican subjects to whom a Spanish language version of the Wechsler Adult Intelligence Scale (WAIS) was administered. The full scale scores for his subjects indicated a continuous rise from age sixteen through age 40, not reaching some terminal asymptote at age twenty-one as Jones and Conrad (1933) had suggested on the basis of their cross-sectional data.

iv. IQ Constancy

To what degree is adolescent IQ stable and unchanging? Do children maintain essentially the same relative status within their age group as they grow older? While related to earlier discussion of intellectual growth rate during adolescence, these questions focus more on individual developmental variability in intelligence than on normative characterization of adolescent intellectual growth. If empirical data can be mustered which support maintenance of the same relative status in intellectual functioning with increasing age, then IQ can be assumed a relatively reliable indicator of mental ability at given age levels and of predictive value for later developmental periods (Ausubel and Sullivan, 1970).

Usually, studies designed to establish the stability of IQ over time test and retest the same children at different age levels, assessing the strength of relationship between obtained IQ scores on the separate occasions. High correlations are interpreted as evidence of IQ constancy while low correlations indicate instability. Studies which rely on the intercorrelation of scores obtained by way of different test types, say a measure of pre-school intelligence and performance on the WAIS yield relatively lower indices of IQ constancy (Bayley,1955), than a procedure utilizing the same measuring instrument applied to the same group on two separate occasions. Absence of a universally applicable measure of intelligence, validly indexing IQ over broad developmental spans, limits firm conclusions absolutely verifying or contradicting the concept of stable IQ. Pinneau (1961) cites that current evidence supporting IQ constancy is mixed and inconclusive, owing partly to methodological approaches and test differences used at various ages.

At best, the mental measurement truism that the older the child when initially tested, the shorter the time interval between initial and subsequent testing, then the greater the predictive accuracy of the initial test, generally applies to the body of research on IQ stability (Anderson, 1939; Bayley, 1940; Bradway and Thompson, 1962; Honzik _et al._, 1948; Meyer, 1960).

General observations such as Bayley's (1949, 1968) indicate intelligence test scores acquire sufficient stability to serve as useful predictors only when children reach school age. Honzik _et al._ (1948), who tested their sample as pre-schoolers, in elementary grades, and as adolescents, found support for increasing stabilization of intelligence with increasing age. While individual fluctuations in IQ were quite common, children retained essentially the same relative status within their age group.

Testing lower middle-class children at the eighth and eleventh-grade levels over a three and a half year interval, Mayer (1960) found overall _Primary Mental Abilities Tests (PMA)_ correlated .82 over the two occasions, with word fluency demonstrating least stability.

Bradway and Thompson (1962) correlated scores on the _Binet_ and _WAIS_ for their sample of adults with their pre-school and adolescence intelligence scores. While pre-school intelligence scores correlated .59 with the Binet and .64 with the WAIS, measures of adolescent intelligence correlated .83 with both tests. Seemingly, adolescent IQ serves as a relatively sound predictor of adult intelligence, but it should be added, a significant amount of variability at later age is left unaccounted for. In the case of Bradway and Thompson's study, 35 per cent of adult intellectual status cannot be predicted using adolescent intelligence scores.

Using test scores obtained on the WISC (Wechsler Intelligence Scale for Children) for 173 normal five through thirteen-year-olds on three occasions separated by yearly intervals, Klonoff (1972) discovered only one statistically significant difference in eighteen between-year comparisons of mean full IQ. Of the nine possible between-two-year comparisons, only two differences emerged as significant. Strength of the correlations increased with advancing age, with greater instability demonstrated by the younger sample than the older. Comparing low IQ subjects to their high IQ counterparts failed to yield any consistent trends in IQ change patterns. Analysis of the relationship between magnitudes of correlations and the interval between test periods demonstrated a perfect inverse relationship.

Whereas overall IQ indices demonstrate increasing consistency with advancing age, tests designed to tap component mental abilities, e.g., Thurstone's PMA, reflect little stability through the fourth-grade. Bennett and Doppelt (1951) and Meyer (1960) offer evidence that such component factor tests of intelligence only acquire sufficient stability to forecast adult aptitudes during the eighth-grade for boys, with lower stability indicated for girls (Meyer and Bendig, 1961).

If one thinks in terms of broad categories of measured intelligence such as low, moderate and high IQ, Elkind (1968) notes that stability of IQ has been largely demonstrated. However, use of absolute scores reduces predictability of IQ with advancing years, for changes do take place, particularly among those who score within the middle ranges of standard IQ test. Most observers make sufficient error in prediction to accept the unequivocality of IQ constancy with age.

v. *Differentiation of Mental Abilities During Adolescence*

A question fundamental to and anticipated by our earlier exposition of structural theories of intelligence is whether intellectual structure changes with age. In effect, the question addresses itself to differential evolvement of special mental abilities, and at one level can be translated into the charge that intellectual structure is transformed from a Spearman-like model of intelligence characterizing younger children to a Thurstone-like model characteristic of older children and adults. In sum, the differentiation hypothesis states that mental abilities proliferate and become specialized with age.

Burt (1962/1921) reviews factor-analytic data distinguishing the relative contributions of general intelligence factors and specific mental ability factors (Spearman's $\underline{g}$ and $\underline{s}$ factors) to test performance on tasks involving mathematical abilities, verbal abilities, and manual facility. His findings generally support the differentiation hypothesis since older school children and college students exhibited a more pronounced use of _s_ factors than did younger children. It appears that as age increased, the importance of the _g_ factor decreased in intellectual performance.

In his studies of nine, twelve, and fifteen-year-old children, Garrett (1946) administered an array of tests designed to measure retention, verbal and numerical reasoning ability. He discovered significant drops in the importance of the general intelligence factor between the extremest age groups. Where for the nine-year-old boys the _g_ factor was involved .31 in accounting for performance variability over the three tests, it dropped to .12 for the fifteen-year-olds. For girls, the respective drops from age nine to fifteen was .31 to .19.

Sampling eight through eighteen-year-old subjects, Freeman and Flory (1937) discovered differential growth rates on each of four scales: _Vocabulary_, _Analogies_, _Completions_, and _Opposites_ (_VACO_). Later conversion of these scores to standard deviation units by Conrad, Freeman, and Jones (1944) revealed that the period between ten and sixteen was characterized by greatest growth rates for _Completions_, second for _Opposites_, third for _Vocabulary_, and least for _Analogies_.

Numerous studies by the creator of the _PMA_ have also demonstrated progressive differentiation of mental abilities with increasing age (Thurstone, 1938; Thurstone and Thurstone, 1946). For example, Thurstone and Thurstone (1941) identified six primary mental abilities among kindergarten children, seven among seventh-grade children, and nine such factors among college students. Others (Heinonen, 1963; Ljung, 1965; Werdelin, 1966) using factor-analytic methods report demonstrable differentiation of intellectual abilities.

During preadolescence and adolescence, vocabulary, general reasoning, and arithmetical ability reach asymptotic levels of development (Conrad, *et al*., 1944; Garrett, *et al*., 1935), with vocabulary growth and ability to understand sentence structure growing at a more rapid rate than general reasoning ability (Conrad, 1944).

In general, the differentiation hypothesis appears to hold up rather well to empirical test. However, it has been somewhat discredited by observations of increasing integration of intellectual functioning with advancing age (Cohen, 1959; Cropley, 1964; Ljung, 1965). Cohen tested children aged seven, ten, and thirteen with the *Wechsler Intelligence Test for Children* (*WISC*) and compared their performance to six-year-olds. Comparisons did not yield any significant changes with age supporting the differentiation hypothesis. Both children and adults exhibit the same factors in intellectual functioning, with adults demonstrating more of the general intelligence factor than children. Cropley's (1964) research with ten and twelve-year-olds using the *WISC* found equivalent factor structures with an increasing tendency toward integration with advancing years. Ljung (1965) suggests that integration increases not only between the various component abilities defining intelligence, but also occurs within the various abilities.

A recent factor analysis of the SRA's PMA test scores for three age groups: grade 7 to 8, 9 to 10, and 11 to 12 children revealed that organizational patterns characteristic of adult intelligence emerged prior to early adolescence (Fitzgerald, Nesselroads, and Baltes, 1973).

Attempts to resolve the differentiation-integration controversy in cognitive development are represented in the work of Green and Berkowitz (1964) and Burt (1954), who recommend a more careful analysis of the possibility that cognitive development follows a pattern of generality in early childhood and during elementary school years, acquiring greater specificity during the preadolescent and adolescent years, followed by a period of consolidation and integration of specific abilities during late adolescence and young adulthood.

At present, with regard to the differentiation hypothesis, the overall evidence appears to support a position of increasing differentiation of cognitive abilities from early infancy through early adolescence. The increase seems to be less due to education and more clearly maturational in nature, a contention which would be in keeping with the Piagetian view of cognitive development (Inhelder and Piaget, 1958).

vi. Representative Differences in Adolescent Intelligence

Since it is beyond the scope of this paper to trace the entire literature addressed to sources of variability in intelligence, such as sex and socio-economic factors,these will be examined selectively.

Studies of sex differences in overall intelligence among adolescents demonstrate little in the way of advantage for either males or females (Terman and Tyler, 1954). This observation is not particularly surprising, since construction of tests indexing general intelligence includes a deliberate strategy to eliminate items with specific content favouring either one or the other sex. Consequently, absence of a sex difference in tests of general intelligence is probably witness to successful implementation of this strategy.

Analysis of component mental abilities, however, reveals the emergence of sex-related patterns in performance. Where boys are more likely to attain higher scores on quantitative and spatial tasks, girls excel on tasks which contain a strong verbal component (Havighurst and Breese, 1967). Bayley (1968), whose California Growth Studies have been reviewed earlier, found that 16-year-old females exhibited clear superiority on WAIS subscales and scored highly on verbal factors, whereas males scores higher on spatial and arithmetic tasks.

Differences in particular "primary mental abilities" have led Henzik (1963) to hypothesize differential growth rates in intelligence between sexes. Bruner and Olver (1963) studying categorizing ability in school-age children, observed that girls were superior to boys through the sixth-grade, where their advantage diminished. In a study of gifted children, males were better able than females to retain high intellectual status (Terman and Oden, 1949). Likewise, males are more often IQ gainers than females from adolescence to adulthood (Bradway and Thompson, 1962).

Elkind (1961a) found prominent sex differences in the development of quantity concepts, when examining his sample of high school and college-age subjects, whereas these differences did not appear in a sample of elementary school children. Consistent with Elkind's observation, Terman and Tyler (1954) reviewing the literature on sex differences to that time, found adolescent boys to be more facile in scientific and mathematical achievement tasks, while girls maintained superiority on verbal tasks.

Emergent sex differences in component mental abilities during adolescence reflects the impact of socio-cultural sex-typing of interests, rather than true differences in mental capacity. The nature of the affectional relationship between parents and child appears to be a key moderating variable in childrens' IQ. Henzik (1967) reports strong correlations between parent and child's IQ when parental ability was high, where prominent displays of maternal concern were evident, and when both parents were concerned with their child's achievement. Other studies have found that male IQ was positively correlated with early maternal affection (Bing, 1963; Bayley and Schaefer, 1965; Bayley, 1965).

Ross and Palmer (1970) in an extensive examination of data pooled from five major developmental studies of child development assessed factors which gave rise to intellectual change, whether to raise, maintain, or lower IQ. Intelligence test score results were available on the research subjects when they were 6, 12, and 17-years-old. Some subjects were born as early as 1921, others as late as 1951. Gains were most evident in the case of girls with brothers, boys with much older brothers or sisters, and first-born children. While boys from broken homes gained less than boys from intact homes, girls were unaffected by this factor. Through age 12 social status and IQ gain exhibited a strong positive correlation, the greater the gain the higher the status. From then on through age seventeen, social class was not implicated as a factor in IQ gain. In a general manner, the relationships between IQ gain and the other factors were more consistent, sharper, and stronger in magnitude for boys than for girls. It would appear from this study results that intellectual competence is more highly valued for boys and men than it is for girls and women. The social forces which produce this differentiation in sexual performance probably take effect during the early adolescent years. Hopefully, current cultural trends, womens' liberation notwithstanding, will balance out the differential sexual emphasis on intellectual competence.

vii. Quantitative Aspects of Early Adolescent Cognitive Functioning; Implications for Educational Practice

The psychometricians have provided an invaluable view of adolescent cognitive growth and intellectual capacity. Their data reflect interest in the methodology of mental testing, with substantive intellectual functioning in adolescence byproduct of their mental measurement emphasis. Nevertheless, the description of adolescent cognitive growth in "crystallized" intelligence is clear. While dramatic physiological changes take place during the early adolescent years, intellectual capacity seems to be little disturbed. Research using IQ tests and mental age indicators find adolescence a period of negative acceleration in intellectual growth. Consolidation of mental ability and a parallel increase in specific mental capacities is noted during this age period. Intra-individual variation in intelligence over time, the question of IQ stability, cannot be answered without some equivocation. While relative intellectual status appears to change little over time, there are prominent variations in measured intelligence which preclude a firm statement in support of IQ stabilization with age. Distinctive motivational and social factors appear to weigh heavily in IQ variability. Until less fragile indicators are constructed, which span longer periods of development, this question will remain unresolved. Sex differences in adolescent cognitive capacity appear when a Thurstone-like model of the structure of intelligence is assumed. Boys are better able to perform on tests requiring utilization of quantitative and scientific concepts, while girls are generally superior on tasks requiring verbal performance.

The quantitative description of adolescent cognitive functioning and development can be viewed as a jagged perimeter to a partially charted geographic area. While it contributes to broad normative description of intellectual capacities relative to age mates, it is a map that fails to record the dynamics and flux of the continent's interior. To come closer to the foliage and rivers of this region we have to consult another perspective.

The educational utility of a psychometric view has been demonstrated on many occasions. When we examine its serviceability in prediction of academic achievement (provided the achievement is tested in practically the same terms and with similar items as these used in testing intelligence), its abuses are also clearly evident. At times, it has been employed to rationalize educational failure. Rather than examining their methods of instruction when performance of a learner is substandard, the first place the educator will look at is the student's record, the IQ scores in particular. If his index is low, then the conclusion is clear, the fault was his. If his index is high, the methods of instruction still remain sacrosanct, since he clearly is an "underachiever", a personal motivational failure. Employment of numbers in this fashion was never intended by the originators of the testing instruments.

3. Qualitative Aspects of Cognitive Functioning During Early Adolescence

Studies of intelligence and intellectual growth rates with attendant corollary questions of IQ constancy, differentiation of mental abilities, and factors influencing intellectual achievement provide a basic, yet limited view of adolescent cognitive functioning and development. Though the mental testing approach has value in providing tentative numerical descriptors of adolescent intellectual growth, by its very nature it precludes detection and description of qualitative developmental changes characterizing adolescent thought. At best, mental measurement produced a convenient operational framework for distinguishing adolescent mental abilities relative to childhood and adult intelligence. Intelligence as measured by various tests of mental ability was and is validly predictive of performance on many tasks, particularly if those tasks do not differ drastically in content and form from the test item clusters (McClelland, 1973).

i. Stages in Cognitive Development

The current resurgence of theoretical and research interest devoted to description and explanation of qualitative changes in adolescent cognitive functioning and development owes an enormous debt to the work of Jean Piaget and the Geneva School (Elkind, 1968). Piaget (1950) has proposed a stage theory of cognitive development which has generated a wealth of original and invaluable insights into the dynamics of thought, its nuances and subtleties, and its progressive transformations with age. The Geneva School has presented and instigated research which serves to demonstrate the validity of the Piagetian stage concepts, as well as forcing reevaluation and modification of formerly held development positions. Few discussions of cognitive development can afford to neglect the studies of Piaget and his students. Few reputable developmental journals publish issues without some sizeable proportion of the articles representing research in Piagetian thought (Elkind and Sameroff, 1972).

Piaget (1950) maintains that cognitive development proceeds invariantly and stage-wise through four relatively distinct intellectual accomplishments: sensorimotor, pre-operational, concretely operational, and formal operational thought. The respective and approximate age ranges during which Piaget's research indicates that these different forms of thought appear are birth to two years of age, two through six years of age, seven through eleven years of age, and twelve through maturity. Though formal operational thought and its characteristics will consume our attention, the features and nature of earlier cognitive developments are necessarily reviewed in order to understand the distinctiveness of the final stage.

During infancy, the infant learns to master his sensory and motor systems, associating spatial direction with locomotive direction, learning to reach where he is looking, coordinating his reflexes and senses, responding to sounds, and so on. Elkind (1967) in an interpretation of Piaget's description summarizes the main objective of the sensorimotor stage as the mastery of the object world.

Following the sensorimotor stage, the child of two through six begins to pre-operationally organize thought, with obvious elementary mastery of symbols. Language mushrooms during this stage, symbolic play increases,modelling and other imitational responses proliferate, and the initial reports of dreams occur.

Concrete operations, the third major stage, represent mastery of classes, relations, and quantities. However, this mastery is deceptive. For while the concrete-operations child has mastered these elements of logic, he regards them as irrefutable and is likely to demonstrate extremely dogmatic and rigid thinking, trying to fit contrary elements into his logical constructs, rather than reevaluating and reorganizing them to accommodate the facts. In addition,through concrete formations the child acquires the ability to conserve numbers, volume, displacement, and weight. These accomplishments are indicative of a growing proficiency in conceptual covariation of dimensions entering into the definition of these concepts. However, this singular facility is constrained by the need to have concrete materials necessary to solve the conservation problem. Their absence clearly reduces this ability (Inhelder and Piaget, 1958; Roberge and Paulus, 1971).

The final stage of cognitive development considered by Piaget, that of formal operations, is characteristic of adolescent and adult cognition and is concisely defined by Elkind (1967) as the "mastery of thought". Since formal operational thought emerges in early adolescence, we will devote substantial space to a discussion of its distinctive features. The reader interested in a detailed and excellent summary of Piaget's developmental theory is directed to Flavell (1963, 1972), who presents the theory's basic elements, research programs which it has generated, and a critical analysis thereof. Our brief review does not do justice to Piaget's enormous contribution to human knowledge.

ii. Formal Operational Thought During Early Adolescence

The formal-operations child has the necessary intellectual equipment for working as a scientist (Brown, 1965). Emergence of those new cognitive abilities coincides roughly with the onset of puberty, though the cognitive growth is more continuous and less abrupt. Among the newly emergent abilities, perhaps the major defining characteristic, is the liberation from a world constrained by concrete objects and events to one of abstractions and hypotheticalities. Deductive and systematic thought develops with the formal-operations child who is characteristically capable of exhausting all possible combinations of elements. When presented with a problem which requires a specific combination of multiple variables in order to achieve a solution, the formal-operations child systematically holds certain combinations constant while varying one element. If that fails, he will change the variable by holding it constant, varying one of those remaining and so on, until a solution is achieved (Inhelder and Piaget, 1958).

Not only is he capable of evaluating logical possibilities, but the formal-operations child is equally adept at creating models of reality, utopias, ideologies, and hypotheses other than those provided by his present environment. In fact, all that can be imagined is also deemed possible. Direct contact with ideas of things, events, situations, and people are not needed in order for them to be represented in imagination. However, when faced with facts which do not match his hypotheses, the formal-operations child, unlike his concrete-operations counterpart, discards the hypotheses in lieu of one better able to accomodate the facts. He can move one way or the other, testing hypothesis against fact, whereas the concrete-operations child maintains a rigid and dogmatic stance, unable to reexamine his idea in the light of contradictory data. The freedom, control, elaboration, and completeness of formal operational thought is not present in earlier stages.

When requested to produce concepts, for example, to state how a diverse array of common utensils or artifacts are alike or different, the adolescent is remarkably more adept than his school-age brethren. Elkind, et al., (1969) compared fourth and ninth-grade children in their ability to produce concepts connecting a shoehorn, table knife and a pair of scissors. The ninth-grade sample produced nearly twice as many concepts as the younger group (4.70 versus 2.88). In addition, the older children were not affected by the absence of the concrete objects, functioning equally well when merely supplied verbal labels. The fourth-grade sample, on the other hand, produced twice as many concepts when the objects were present than when they were given verbal labels.

In another study, Elkind, et al., (1970) asked nine and fourteen-year-olds to state how pairs of pictorial stimuli were alike. The number of concepts produced decreased as the stimuli became more abstract for the nine-year-old sample, while perceptual concepts decreased with increasing pictorial abstractness for the fourteen-year-old sample. The latter result represents fairly persuasive support for the adolescent's greater ability to shift his mode of conceptual orientation.

In addition to demonstrating liberation from concrete referents, the adolescent becomes capable of focusing his attention on the essential elements of a problem, inhibiting irrelevant thoughts, not being distracted by incidental information, organizing, reflecting, and reaching some decision on a problem. Logical and systematic information-processing dominates, with the formal-operations child being able to solve transitivity problems such as X is lighter than Y, X is darker than Z, who is the darkest of them all? Piaget (1950) recommends that it is the rare child who has the capacity to solve such a problem before the age of 11 or 12. Donaldson (1963) generally supports this strong claim that children between 12 and 14 increased in their willingness to accept and work within the limiting conditions of a defined problem. However, this does not mean that a formal-operations child will always reason logically, i.e., formally. Her observations of early adolescent problem solving indicated that increasing the difficulty in solving a problem by introducing progressively more limiting conditions produced a tendency to ignore the premises of a problem and to regress to a more primitive level of thought.

While Piaget's claims for the universality of formal reasoning in adolescence and maturity are generally supported, the conclusion that adolescents are capable of demonstrating formal-operations reasoning in all instances and situations is erroneous. Though the adolescent is manifestly superior to his younger counterparts in this propensity, flights from logic are often exhibited in his thinking as well as that of mature adults (Wedford, 1958).

Sufficient variability in abstract reasoning between situations and content matter has been noted in adolescents to warrant modification of the general principle favoured by Piaget (1950) that abstract reasoning in one area is indicative of formal operational thought in all. For example, Stone and Ausubel (1969) compared seventh and tenth-grade students in their ability to acquire and utilize science, social studies and literary concepts. They found similarities in acquisitive ability between the two groups, which may reflect that acquisition is a lower level form of reasoning, probably reflecting rote learning. However, application of concepts revealed superiority in favour of the tenth-grade children. Since concept utilization requires greater understanding, this difference was expected. Contrary to a Piagetian prediction, the researchers found higher correlations of utilization test scores for the tenth-grade sample than the seventh-graders between the areas of application. Seventh-graders were unevenly distributed in their ability to think formally in these three areas. Tenth-graders, on the other hand, more consistently used abstract formulations in applying concepts learned in these three areas.

Replication of Inhelder and Piaget's (1958) formal-operations stage experiments by Dulit (1972) using 97 average adolescents, 44 gifted adolescents, and a control group of 12 average adults, led him to generally support the Piagetian results. However, contrary to Piaget's contention that the full development of formal reasoning in adolescence and adulthood was commonplace, Dulit observed that differences in performance were specific to the nature of the task rather than content-free. Lovell (1972) reviewed and reported several studies with adolescents which suggest support for a view of formal operational reasoning as content-specific. Consistent with Dulit's position, he observed that history and historical concepts were not fully grasped by adolescents until age sixteen.

Adelson, et al., (1969) have reported relatively late maturity of formal operational thought in the related area of legal and and governmental concepts. Studying four age groups, from approximately eleven through eighteen years of age, dichotomized into a high (125 or more) IQ group and an average (95-110) IQ group, they noted dramatic age-related changes in concepts of law. Prior to fifteen years of age, the adolescent possessed a vague sense of the law, demonstrating insensitivity to questions of civil liberties, preferring expeditious and authoritarian solutions to social and community problems. After 15, new trends in views of law emerged, characterized by expressions of awareness and interest in individual rights, recognition of the need to restrict governmental control, and an appreciation of the social contract which was minimally necessary for the conduct of democracy. Intelligence and sex did not have any notable effect on their concepts of law. Adelson (1973) argues that this expanding awareness at fifteen is a result of the basic consolidation of formal operational thought. Certainly, assessment of the desirability of a particular set of laws or social order requires the ability to imagine alternative political systems. Perhaps, the notable disillusionment with and voluntary self-disenfranchisement from existing political systems is an indicator that formal operational thought has reached full fruition in the adolescent.

When Piaget (1941) concluded that formal operational thought was fully established by approximately age 12, he based his conclusion on research which indicated that abstract responses to mass appeared by age eight, to weight by age ten, and to volume by age twelve. However, replication of Piaget's study by Elkind (1961) using a similar age group failed to confirm his finding with respect to volume for 11 to 12-year-old children. Elkind (1961) decided to administer the Piagetian tasks used to determine the attainment of abstract conceptions of quantity to an older sample of subjects. He chose 469 junior and senior high school students, and found that while 87 per cent had acquired abstract conceptions of mass and weight, only 47 per cent had attained abstract conceptions of volume. With increasing age, from twelve through eighteen, mastery of the volume task increased. Measured intelligence correlated with passing the volume test. Boys were more consistently higher than girls in their mastery of volume tasks.

Recently, Nadel and Schoeppe (1973) studied conservation of volume using eighth grade girls, producing results amazingly parallel to those obtained by Elkind (1961). He reported that 29 per cent of his sample of girls whose age averaged 13.6 were capable of solving the conservation of volume task. Nadel and Schoeppe found in their sample of girls, who coincidentally averaged 13.6 years of age, that only 29 per cent were capable of solving the conservation of volume task.

Elkind (1961) has argued that attainment of abstract quantity concepts is dependent to a great degree on the selective role of intelligence, age and sex with their correlates. Deutsche (1937) found causal relations were easier to grasp for more intelligent children. Elkind's (1961) assessment of IQ and attainment of volume concepts, revealed the presence of a significant relationship between IQ and passing the volume tasks.

Yudin (1966) provided further support for the moderating effect of IQ on formal reasoning, when he tested attainment of abstract concepts in his sample of school-age children and adolescents. Examining performance tasks requiring abstract reasoning by age and IQ, he found high IQ children were more likely to make gains prior to age twelve, average IQ children made their most prominent gains between twelve and fourteen, while low IQ children gained most between fourteen and sixteen.

Jones (1972) held IQ constant for his sample of sixth-grade boys, and tested the relationship between verbal ability, use of tentative statements and hypothetical reasoning ability on an experimental task. Neither verbal ability nor use of tentative statements influenced hypothetical reasoning ability. This result, or more accurately non-result, provided support for the Piagetian view that the stage of formal operations is a developmental imperative, holding only a tenuous relationship to the use of language and language style.

Sex differences in attainment of particular abstract concepts have been noted. Elkind (1961) found that his sample of junior and senior high school girls had greater difficulty in mastering volume tasks than boys. The measurement of primary mental abilities, cited elsewhere, lends support to the validity of this observation. Males generally demonstrate superiority to females in quantitative reasoning and scientific tasks. A unique index of sex differences in formal operational thought has been recently presented by Khatena (1972). Assessing original verbal images created by children aged nine through nineteen on a Sounds and Images measure, Khatena found boys exhibited a prominent shift in the production of original expressions between the ages of ten and twelve, while a parallel development in girls occurred approximately a year later (eleven to thirteen years of age).

Dependent on content area, distinctive age trends emerge in the developmental of formal reasoning during early adolescence. As noted by Elkind (1961), attainment of the volume concept increased with age from twelve through eighteen. On the other hand, Seggie (1970) demonstrated that both twelve-year-olds and college students were capable of grasping conjunctive rules when the logical relationship between individual attributes and a conjunctive concept were demonstrated. Peel and De Silvam (1972) content-analyzed adolescent literary achievements, finding late adolescents produced more abstractions and classificatory concepts than early adolescents.

Yudin and Kates (1963), in a development study of concept attainment, presented a series of slides to twelve, fourteen, and sixteen-year-old children, requiring them to classify each series with a single attribute such as black or cross. The correct response was possible to obtain after viewing four initial slides. Every subsequent three-slide cycle gave enough information to solve the problem. Their results identified significant age differences in attribute selection. Fourteen-year-olds were more facile at mastery of the concept than twelve-year-olds, while no significant difference was evident in the performance of fourteen and sixteen-year-olds. Typically, the youngest subjects gave answers which indicated that they failed to utilize the present information and were unable to recall their previous responses to check them against incoming information. When the current information confirmed their guesses they were less able to continue responding accurately, and demonstrated more reluctance to change their guesses when the current information was disconfirmatory. On the other hand, the older subjects were more likely to maintain their confirmed guesses and relinquish those disconfirmed by earlier performance. Clearly, the fourteen and sixteen-year-olds seem more malleable and responsive to environmental information. Feedback as to appropriateness of response made a difference in their performance while affecting little the behaviour of the twelve-year-olds.

Another feature of formal operational thought is the increased tendency of the adolescent to offer higher order explanations of phenomena and understand that phenomena can be logically explained. Peel (1965) provides a series of illustrations which reflect the adolescent's tendency to only feel satisfied with an event after being able to offer sufficient explanation for it. Whereas the younger child stops at the point of description, merely relating one event to another, the formal-operations child seeks to relate the phenomenon and its parts to other phenomena. For example, the elementary physical experiment of causing a tin to collapse by boiling a little water in it, stoppering and cooling it immediately, serves as a remarkably effective event for generating explanations. Where the pre-formal-operations child would merely describe the event, the formal-operations child needs to arrive at an explanation which not only explains the event, but also leads to the development of a general principle which allows prediction of related events, e.g., effect of going into the atmosphere or deep into the sea. Gesell, et al., (1956) have charted the normative growth of philosophic outlook through age sixteen which supports Peel's description of the adolescent as a thinker.

In addition to deductive and systematic thought, search for explanations, and ability to divorce subjective ideas from concrete referents and the external world, adolescence is characterized by a closely allied need to impose meaningful structure on the environment. Vickers and Blanchard (1973) in a unique developmental assessment of cognitive balancing using Heider's P-O-X model as a basis for the experimental task, found that with age, children developed models of social relationships which reflected the need for consistency. Triadic arrangements of social relationships between persons, objects and others, were generated with one connection missing. When fourteen-year-olds were compared to pre-operational and concrete-operations children in their selection of the missing connective, they were significantly more able to identify a connection which balanced the triadic relationship. Concrete-operations children seemed to prefer positive connectives, regardless of their implications for the consistency of the relationship, while pre-operational children chose connectives in a purely random and chance fashion.

Ability to grasp the metaphorical as opposed to the literal content of artistic and literary endeavours is attendant with formal operational thought. Shaffer (1930) found that only during the 12 to 14 age period were adolescents demonstrably capable of going beyond the literal meaning of cartoons. Pyle (1935) indirectly demonstrated support for Shaffer's observation when his preadolescent sample failed to exhibit understanding of metaphorical content in their analyses of poetry. Studies of adolescent understanding in social studies (Case and Collinson, 1962) as well as appreciation of religious concepts (Goldman, 1965) indicate the inability of the younger adolescent to appreciate metaphorical and metaphysical concepts. Studies of conscience development stress the importance of cognitive factors in making moral judgments (Kohlberg, 1957, 1968; Piaget, 1932). Conscience appears to stabilize with the development of an adequate self-critical faculty, which has been noted as a significant event in the growth of formal operations (Inhelder and Piaget, 1958).

Growth in formal operational cognitive structure depends on cultural milieu. Maccoby and Modiano (1969) compared concept formations in 12 and 13-year-old Mexican children from a peasant village and an industrialized setting. Using an array of items including banana, orange, bean, meat, milk, air, fire, and stone, the child was asked to compare and contrast ordered combinations of these items. The village child was more likely to offer concrete, perceptual terms stressing the similarities between objects, while the urban child was sensitive to similarities, classifying them abstractly, either by name or by function. The others contend that the differences characteristic in the rural-urban responses reflect the demands of the culture. Where rural societies are concerned with concrete referents and distinguishing features of objects, urban settings are concerned with abstract classification and equivalence.

Changing perception and awareness of time is another distinguishing feature of formal operational thought (Inhelder and Piaget, 1958). Certainly success at problem solving is highly correlated with reflectivity, implying some time delay before responding. Future orientation among children was examined by Le Blanc (1969) by analyzing stories constructed as a response to a series of pictures. Subjects included school children, adolescents, college students, adult businessmen and retirees. Through college-age, the trend in future orientation reflected by these stories indicated increasing awareness of time with age. Adolescents were more future-oriented than children, college students more future-oriented than adults. Surprisingly, adolescents exhibited longer future orientations than adults. Piaget (1954) suggests that a concomitant characteristic of the advent of formal operations is the ability to symbolically represent time and grasp historical concepts. Adelson and O'Neil (1966) offer some supplementary evidence that historical concepts are easier to understand and handle for the formal-operations child.

iii. Educational Implications of Qualitative Changes in Adolescent Cognitive Functioning

Piaget's theory, by virtue of its view of the universality and immutability of cognitive development, does not evangelically pursue modification of school curricula. Since the stage-wise development of thought is dictated by the interaction of bio-physiological structures with the environment, and cannot be either advanced or retarded except by the most extreme and unnatural measures, Piaget does not offer a primer on educational technique. Where a solely behaviouristic view would struggle to recommend environmental changes needed to facilitate the acquisition of discrete behaviours and facts, the cognitive-developmentalist of the Geneva School is reluctant to recommend educational practices that precipitate and speed developmental rates. However, this does not mean that the body of theory and empirical fact reviewed has no implications for educational practice. On the contrary, remarkably lucid and beguiling criticism can be levelled at existing pedagogical arrangements for failure to take into account the development of thought. For example, teacher expectations that a child of concrete operations capture the metaphorical meaning of a Lewis Carroll fantasy can be justifiably criticized knowing that this ability only makes its appearance during the formal operations stage of cognitive development. Expectations that a child can master abstract concepts of quantity, particularly volume, prior to middle childhood are equally doomed. While formal operational thought is a necessary accomplishment in order to treat abstract concepts, we have noted that this generalization has to be limited by considering the particular area of abstraction. For example, early adolescence (ages 11 through 13) is unresponsive to the subtleties of combinatorial logic and metaphorical concepts (Elkind, 1968). Tasks involving volume concepts are equally unwieldy for this age group, particularly females (Elkind, 1961). Concepts of history, law, and politics are equally blurred in early adolescence (Adelson and O'Neil, 1966; Adelson, et al., 1969).

The basic and general tenets of Piagetian thought have been empirically substantiated. In order for education to be most effective, it cannot disregard these observations, but must attune its methods to the qualitative dimensions of adolescent cognitive functioning. Part of the difficulty in applying Piagetian findings is the absence of convenient and economical indicators of the adolescent's cognitive development à la Piagetian stages. Recently Tuddenham (1966) as well as Pinard and Laurendau (1969) have attempted to prepare and standardize tests based on Piagetian concepts of intelligence. While these tests are directed at differentiation of earlier developmental stages, hopefully further efforts will take place, as some have (Pinard and Sharp, 1972), to construct and validate psychometric devices for the assessment of formal operational functioning with different cognitive contents. Availability of these measures would allow a meaningful modification of educational programs designed to accomodate the abilities characteristic of different adolescent populations, perhaps requiring the introduction of newer, more productive methods and disposal of antiquated, non-utilitarian approaches.

iv. Development of Thought and Language: Vygotsky's Theoretical Perspective

There exists another theory which is more specifically a developmental theory of education, similar in its emphasis to Piaget yet more directed toward educational needs of the child. Lev Semenovich Vygotsky, a Russian theorist who died in the early 1930's, assumed that the main purpose of education was knowledge, through which emotion is secondarily integrated. His theory concerns the use of language as a tool in the development of the intellect, culminating in its highest form, consciousness.

As a consequence, his methods are basically different. Vygotsky believed that man masters himself by mastering nature, and that man is formed by the instruments he uses in achieving this mastery. It is, therefore, a mediational theory, since it is through the use of the tools of language and thought that man is able to internalize reality.

It should be evident, even from this brief introduction, that Vygotsky's view of education is both a theory of the development of cognition, and also of the nature of man. They are both interconnected, so that language and thought give the power and strategy to cognitive activity whereby reality can be mastered and simplified. The role of education is to develop consciousness, and thus imports the consequent ability to be free of one's history. Bruner (1962), in his introduction to Vygotsky's book, summarizes, saying it is "an image of man that places the effort to learn and master into the centre of the stage as an instrument that frees us of earlier efforts and results".

Vygotsky's theory is more explicit concerning the earlier stages of life. Nevertheless, he sees the adolescent years as being of prime importance. To understand the possible applications of his theory to adolescent education, a brief presentation of his entire theory is necessary. A discussion of the approach to the problem will be followed by the manner in which consciousness is reflected developmentally, especially in the formation of concept. The culmination will be the application of these ideas to education.

There have been two extreme approaches to the problem of thought and language. One approach views thought and speech as one and the same thing, speech being the mere outward manifestation of thought. The other extreme holds that both are independent processes, with an artificial connection between the two. For Vygotsky, the only true approach is a unit analysis, studying the relationship of thought and language, thus overcoming the division of a person. To do this, the object of study is the "word meaning", a unit which combines into a verbal compound the central aspects of both thought and speech. It is a system designed to unite the affective (speech, at least in its virgin state), and intellectual (thought) properties of man. An understanding of this unit unearths the importance of intellectual development, united to the secondary stress on the emotional.

The roots of thought and speech are separate, both phylogenetically and ontogenetically, and develop along separate paths. These two lines of development eventually unite, speech becoming rational, and thought becoming verbal, approximately at the time the child discovers each thing has a name. In a very young child, the function of speech is merely vocal social communication, with a very simple global multifunctional message. Thought does exist, but separately. In a sense, speech, per se, is irrational and basically emotional. The cry of a very young baby is an example. The functions of speech become gradually differentiated, until at a certain age, social speech divides into communicative speech (basically the same as the affective communication described above), and egocentric speech, which becomes the instrument of thought.

Egocentric speech appears when the child begins to transform his external behaviour patterns into inner processes. On the surface it seems as if the child is talking out loud to himself, but it is definitely more than this. It is a type of self-directing tool, a means of planning and seeking answers to a solution, and guiding himself to resolve the problem.

This egocentric speech gradually is internalized as its function changes, seemingly becoming more regulative. Egocentric speech, the tool of behaviour regulation, in a sense goes underground, becoming inner speech, the base of both logical and autistic thinking. It is the interior form of behaviour control; inner speech is the seed of thought.

Vygotsky (1962) summarizes this development in the following manner.

> "Thought development is determined by language, i.e., by the linguistic tools of thought and by the sociocultural experience of the child...The child's intellectual growth is contingent on his mastering the social means of thought, that is, language." (p. 51).

It should be noted here that language need not be spoken language. Its role is the same in any form.

There always remains a constant interaction between inner and outer operations, even when thought has been developed. Examples are legion. Students often learn better when able to express themselves verbally; speakers may prepare for a talk by speaking out loud. Nevertheless, the union of thought and speech is never complete, for they are different in their development and function. There are large areas of nonverbal thought, in which thought is not directly related to speech, and of non-intellectual speech. The fact still remains that much of the development of thought is determined by language.

The concept of the gradual internalization of thought is essential for an application of Vygotsky's theory to education, for it implies certain corollaries, which will be seen to be applicable to any age. Egocentric speech is most noted when the child has to face a problem. This encounter necessitates an "awareness" of the activity, the process being reflected in the self-directive speech. The obvious conclusion is the necessity of arranging relevant problems so that a student will learn to think. Another implication is that the speech structure mastered by a child becomes the building blocks of his thinking.

This developmental overview leads to an explanation of Vygotsky's views on concept formation. It is remembered that higher psychic processes are mediated through the sign, the word, which first helps form the concept, and then becomes its symbol. Since language and thought join at a very early age, there exist even in pre-schoolers the functional equivalent of concepts. These functions do not basically change; however, the means, the process by which this occurs, is different, so that true concept formation arrives only with adolescence, with the onset of puberty.

More specifically, Vygotsky, based on his experimental research, divides the formulation of concepts into three phases, each of which has several subdivisions or stages. The chronological division has much overlap so that true adult concepts can appear early in life in its basic form.

The first phase consists of syncretic images, or unorganized "heaps", into which objects are grouped without any intrinsic basis in reality. The connections instead are unstable and subjective. Examples are random groupings, organization according to the child's visual spatial field, or a combination of these two.

Phase II, labelled "thinking in complexes", is basically a joining by synthesis, wherein actual bonds are used, in addition to subjective impressions, to group. The bonds, however, are concrete, factual, experiential, rather than abstract or logical. In terms of egocentricity, there is less of it than in Phase I, but the child is yet unable to rise above the elements.

There exist five types of complexes: 1) association - the bond need not be a common trait; 2) collection - this is an association by contrasts; 3) chain complex - this purest of complexes has no inherent nucleus, so that any concrete attribute can act as the reason for the next object to be added to the chain; 4) diffuse complex - this is based on a vague limitless connection, within the bonds of the factual object; 5) pseudo-concept - this transitory phase resembles the true adult concept, since the language is the same, but the process by which the grouping is achieved is still concrete and factual.

The pseudo-concept complex is the link to true conceptual thinking. The adult concept offers the exterior form of the concept through the medium of language into which the pseudo-concept can change and develop into a true concept. "Verbal intercourse with adults thus becomes a powerful factor in the development of the child's concepts" (Vygotsky, 1962, p. 69).

The third and final phase, abstraction, complements the other root of true concept formation, synthesis. It brings about the separation into elements. The first division of global perception occurs when maximally similar objects are grouped. To do this, it is necessary to pay attention to some traits more than others. The next development presupposes the abstraction of a common single attribute as the basis for grouping. Finally, true concepts are defined as the formulation of a concept on an abstract level, and then applying it to new concrete situations.

Luria (1969) stresses the importance of Phase III.

> "Only in the next stage (read phase), which is formed under the influence of systematic training, is there substantial change. The word, changing its structure, is given a new, important meaning in the execution of the task. In this stage which, according to Vygotsky, is attained only during adolescence, the word becomes freed from the influence of direct impressions. It abstracts now one, now another attribute and synthesizes them into a complex of attributes. The process ot classification acquires a complex character mediated by the word... Generalizztions underlying the word lose their concrete character...The word becomes the basic instrument of thinking, and thinking acquires a mediated character." (p. 135).

The stress is on adolescence as the important period, wherein one truly learns to think. It is a time of crises and transition, rather than completion. An adolescent may revert to elementary forms of concepts in many areas of thinking; he may not be able to express himself well in a verbal mode, even though he has formed a true concept. Luria also underlines the importance of education (systematic training) in the development of thinking.

It is evident that the adolescent era is a very fruitful time for learning, and learning to think. It is therefore essential to analyze and set up methods so that this situation can be utilized to its full extent. The development of conceptual thinking, being a creative rather than a mechanical process, needs environmental, academic demands so that problems are created which need the formation of new concepts for a solution.

Luria has expanded and expounded on Vygotsky's premises so that the theory is often referred to as the Luria-Vygotsky theory of thought and language. He has related the developmental aspect to more specific age-related stages (Luria, 1959, 1969; Wozniak, 1972; Meichenbaum, 1973), stressing the change from the regulation of behaviour via the motor aspects of speech to regulation by the semantic content.

This may be better understood by an explanation of three hypotheses (Miller et al., 1970) Vygotsky had postulated that there was a progression from external to internal control, from the speech of others directing one's behaviour until self-regulation through language. A concept borrowed from Pavlov's two-signal system expounded this. Speech at first acts like any other first signal system, the physical characteristics of speech controlling behaviour. Later, verbal control shifts to the second signal system, the semantic aspect of speech. Speech becomes self-controlling, a means of orienting to a stimulus.

The third hypothesis is Luria's own. Since the motor aspects of speech develop more quickly than the general motor system,speech through self-direction can be used to help the orderly formation of the motor responses which it accompanies. Thus a child talks to himself to help perform the motor functions at hand. This is one of the earliest instances of the regulative role of speech.

a) Applications to Education

Having understood the types and development of concepts, and being aware of the importance of education, the question still remains: what is the specific role of the school in the development of thought?

Vygotsky answers by differentiating two general types of concepts, encompassing the specific classifications: spontaneous (non-scientific), and non-spontaneous (scientific). Spontaneous concepts are formed through self-discovery, creatively out of one's own experiences, thereby imbuing the concept with one's own individuality. It is mastered through personal practical experience, and not as verbal formulations (Luria, 1969). Scientific concepts, on the other hand, are achieved primarily through instruction and learning. What, then, is the relationship between instruction and the development of scientific concepts?

Vygotsky wanted to counter two common opinions. Scientific concepts are not absorbed prefabricated by understanding and assimilation. A process of development is essential. Secondly, he stressed that non-spontaneous concepts are not similar to spontaneous concepts in their formation. Scientific concepts (Luria, 1969) originate through school training. They are mastered first as verbal formulations, being immediately conscious and voluntary. As such, they have no practical content and must return to facts to gain their proper orientation. It is because of this occasional weak base of factual knowledge that scientific concepts can dislodge to form a body of empty verbal formulations.

In education, both types of concepts are needed, even though scientific concepts are more properly the domain of instruction. Direct teaching of concepts is a vain task, resulting in an "empty verbalism", a camouflage of words over a vacuum of true knowledge. The two processes are really parts of a unitary process in the development of concept formation. Although different in their source, as related above, they are not antagonistic but related, constantly interacting and influencing one another. The knowledge of the level of development of spontaneous concepts is essential to the development of non-spontaneous concepts, precisely in order to forestall words without real meaning, without a reflection in reality. The mental development must reach a certain prerequisite upon which scientific concepts can be built.

Looking at it from another point of view, maturation and learning are both seen to be important, both developing in reverse directions, albeit still connected. Spontaneous concepts are nonconscious, the object of attention being centred on the object itself, as opposed to the act of thought. These spontaneous concepts, based on concrete situations, move upward, reaching a certain level before becoming more refined through the scientific concepts. They give the structures necessary for the concrete application of scientific concepts.

The non-spontaneous concepts are formed through the mediation of the word (adult verbal meanings) which is the basis of flexible thinking, containing within itself all the systems, past and present, simple and concrete to the very complex and abstract. They move from the top down, through the spontaneous concepts, becoming more generalizeable as they become elementary, concrete, and able to be applied to other areas. They impart a system to concepts, which Vygotsky considered essential for consciousness and deliberate control.

The relationship of the two types of concepts is really a question of the relationship of school instruction to the mental development of a child. "Instruction is one of the principal sources of the schoolchild's concepts and is also a powerful force in directing their evolution; it determines the fate of his total mental development" (Vygotsky, 1962, p. 85). It does this by making the child conscious of the operations of his intellect, focusing on the process, thereby leading to mastery of the process. It is through education that nature is mastered.

The student gains consciousness of being conscious, i.e., of being aware of his mental functions. "School instruction induces the generalizing kind of perception and thus plays a decisive role in making the child conscious of his own mental process...Reflective consciousness comes to the child through the portals of scientific concepts" (Vygotsky, 1962, p. 92).

Why should a student not be aware of the more familiar spontaneous concepts, yet be aware of his scientific concepts? "Because the teacher, working with the pupil, has explained, supplied information, questioned, corrected, and made the pupil explain. The child's concepts have been formed in the process of instruction, in collaboration with an adult. The medium of the concept is the word" (Vygotsky, 1962, p. 107).

Although Vygotsky appears to be emphasizing instruction over self-discovery, he is rather stressing the short-comings of spontaneous concepts. Education wherein the student learns entirely on his own appears to be inherently limited. There must be a top-down corresponding development, an imposition of a system through instruction so that concepts can become subject to consciousness, and therefore more generalizeable. This is the real contention - only through instruction can one rise above facts to conquer facts.*

Vygotsky stresses both, self-discovery and feelings, with the resources of the word, the emphasis being on the latter. The goal is knowledge, meaning the ability to think in all aspects of life. As such, it includes emotions. It is the ability to regulate one's life through the medium of the word.

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* A comment. Vygotsky has one inherent limitation. Where do these scientific concepts come from in the first place so that they can be passed on from adults to children, if spontaneous concepts can only rise so far? Although he does not directly answer this, it is possible that the evolution of language was a push-pull system, pulling itself up in a sense by its bootstraps.

Vygotsky must be properly understood. He definitely does not advocate a direct teaching of concepts. As stated previously, this leads to a parrotlike repetition of empty verbalism, with no foundation in reality. Instruction has a much broader connotation here. It means being aware of the upper and lower thresholds of both spontaneous and non-spontaneous concepts, and employing both. Good instruction precedes and refines development. It suggests teaching, not to a student's level, but to his possibilities. This implies an awareness of the most fruitful time for certain subjects, and for levels of difficulty within topic areas.

All this can best be done by creating the context, the problem, which will induce the student to regulate his own behaviour through his thought. These efforts can then be refined by the teacher's explaining, informing, questioning, and so on.

The importance of Vygotsky's views in adolescent education is forceful. If true concepts are not formed until adolescence, it is this time that is most dynamic, and most fruitful, for academic advancement. Therefore the most effort on the development of the curriculum, and the knowledge of individuals, should be in this age group.

There are certain practical implications blossoming from this theory. One concerns the concept of "formal discipline", usually associated with the name Herbart, and the teaching of Greek and Latin.

Viewing this idea through the eyes of Vygotsky sheds a different light on this feared proposal. Vygotsky distinguishes two kinds of instruction. One is the narrowly specialized skill-training such as learning to type, which requires practice and habit formation. The other form of instruction is that which activates large areas of consciousness; it is here that the concept of formal discipline may still be of value.

It is best understood through the discussion of the need for learning grammar, and writing. Grammar is "of paramount importance for the mental development of the child" (Vygotsky, 1962, p. 100), helping the student ascend to a higher level of speech development. Written speech is a "deliberate structuring of the welt of meaning" (Vygotsky, 1962, p. 100) being more complete yet more abstract and removed from immediate needs than oral speech which is often truncated and condensed.

Written speech "assumes a much slower, repeated mediating process of analysis and synthesis, which makes it possible not only to develop the required thought, but even to revert to its earlier stages, thus transforming the sequential chains of connections into a simultaneous, self-reviewing structure. Written speech thus represents a new and powerful instrument of thought" (Luria, 1969, p. 142).

The interpretation seems to be that formal discipline does indeed aid the development of thought, as was commonly propogated. Inner, folded, speech can evolve from different types of outer, unfolded, speech. The functional and structural features of subjects such as grammar and written speech come later in development, enriching inner speech by delaying and inhibiting the direct appearance of speech connections, increasing the need for a preliminary internal preparation for external speech. It helps in learning how to think. This does not necessarily imply a return to the teaching of Greek and Latin, but it does imply the importance of using different methods to help inner speech reach its fullest development. A corollary is that there is a necessity for certain obligatory core courses.

Luria notes in his analysis of the interrelationship of thought and language, two more uses of speech. It quickens the learning process, since labelling facilitates discrimination. External speech also, even in adults, helps sensory analysis become more precise and stable.

The basic theory being unveiled, it remains to see if modern research has reinforced the veridicality of the Vygotsky-Luria premises.

b) Research Results

In this review of experiments which directly or indirectly test the relationship of speech and thought, there is of necessity a return again to a more general view, as opposed to being specifically concerned with adolescence. If the results basically support the proposed concepts, then the conclusions may tentatively be extended to the 11 to 16 age range.

Most of the experiments have used a particular experimental method to test the theory, asking if self-instruction could modify external behaviour. Certain results have stood aginst the use of language in directing behaviour. Wilder (1968) found that, for three and five-year-olds, there was no evidence that overt self-instruction was beneficial. Similar results were reported by Jarvis (1968), who noted that there was also no age relationship of self-instruction and control over performance, as Luria had suggested. Miller _et al._, (1970), using four different age groups, also concluded that "there is certainly considerable evidence that these phenomena do not reflect a pervasive process that is basic to human development" (p. 663). The authors did suggest, however, that the lack of positive results may reflect more the nature of the experimental task, than the general relevance of language for human development.

Meichenbaum (reported in 1973) in his initial results also concluded that overt self-instructions did not have any affect at any age. However, he modified the task to test the same hypothesis, and achieved positive results. Meichenbaum and Goodman (1969) reported clear support of the notion that language can help control behaviour, and that it was age-related. Later, however, Meichenbaum (1971) noted that, even though the basic concept remained, Luria's age-related stages of development could not be substantiated, and that children as young as 2½ to 3 were responding to the semantic aspect of speech. The intervening variable of individual differences appears to be of relevance here (to be explained following), since this was noted with a cognitively-reflective child.

The progression from overt to covert, outer to inner speech, may be more related to task competency than to chronological age. If the task is more difficult, the child verbalizes more. As he increases in proficiency, his control interiorizes. This proposal, however, seems limited in its scope. It is more likely that the internalization of speech into an inner-directing procedure is more complex, depending on the interaction of age, individual differences, task complexity, and perhaps other factors, such as sociocultural milieu, etc. It should also be noted that the age-relationship of conceptual ability has not been explained. It may be that internalization is not necessarily age-related, but the ability to conceptualize may still mature at adolescence.

Meichenbaum did use the hypothesized sequence of internalization as a model for therapy or training of self-control, and to develop new cognitive approaches. This paradigm was successfully employed in teaching impulsive children greater self-control (Bem, 1967; Meichenbaum and Goodman, 1969, 1973; Bates and Katz, 1970; Karnes et al., 1970; Meichenbaum, 1971; Palkes et al., 1972). The method was also successful in increasing attention in test-anxious students (Meichenbaum, 1972), and in schizophrenics (Meichenbaum, 1969; Meichenbaum and Cameron, in press). As an example of modifying cognitive style, Meichenbaum (1972) was able to foster creative thinking in college students.

Kohlberg et al., (1968), in a review article, reached the following general conclusions based on a number of completed studies (Vygotsky and Luria, 1930; Jensen, 1963; Klein, 1963; Flavell et al., 1966; Gratch, 1966; Keeny et al., 1967). They concluded that private speech did have developmental trends, and as it became more covert, it increased in its task-relevant usage and its cognitive self-guiding function. They also noted that private speech had a functional role, for children who used it more were more successful in their tasks. It improved cognitive performance.

On this basis, Kohlberg et al., completed four studies of their own. They noticed that private (unfolded) speech reflected the level of cognitive development, almost completely disappearing by age 10* suggesting that control had become internalized. A major factor in the development of private speech was the cognitive task difficulty, private speech increasing in proportion to the demands of the task. This reinforces Vygotsky's educational proposal of setting up task difficulties at the student's developmental level, thereby increasing his own self-direction, which can then be refined into scientific concepts by the teacher.

The theoretical implications are broader than even Vygotsky had imagined. Self-informing behaviour does not seem to be just task-oriented. They noted that private speech was also related to social popularity and participation. Other research noted previously suggested other areas of application, such as attention, psychological pathology, and creativity. It seems that the Vygotsky-Luria analysis has "some central developmental meaning" (Kohlberg et al., 1968, p. 733).

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*Flavell et al., (1966) noted that private speech still existed in 10-year-olds. This may be explained by incomplete internalization, individual differences, or the fact that internalization is an on-going process for some reason.

The educational connotations of this are profound. If education is the key to the internalization and level of conceptualization, and if this has as wide an application as suggested, then the responsibilities and possibilities of educators are immense, especially in the adolescent years. The means of guiding one's behaviour, academically, socially, emotionally, etc., can be refined through education.

The problem of individual differences had already been mentioned. Flavell et al., (1966) had noted in their study of private speech that there were two basic types of users of private speech: spontaneous rehearsers and non-spontaneous rehearsers. The former, who used unfolded speech to guide their behaviour much more readily, generally performed better on a series of different tasks. Keeny et al., (1967) discovered that the non-spontaneous rehearsers could be trained to rehearse, thereby improving their performance, but that they did not maintain this strategy.

Meichenbaum found a similar division based on the cognitive styles, labelling them reflective and impulsive respectively. After a series of studies (Meichenbaum and Goodman, 1969; 1971; 1973), he concluded, "...cognitively impulsive children do not habitually and spontaneously analyze their experiences in verbal terms and do not formulate and internalize rules that might guide them in new learning situations".

In summary, experimental results have basically upheld the Vygotsky-Luria hypothesis of language as an important step in cognitive development. The relevance has been shown to be wider than mere cognitive style or intellectual ability; the internalization of language has a self-directing influence on seemingly all stages of development, suggesting that the role of educators is broader than might be imagined. It points rather to the formation of types of programs for controlling all kinds of behaviour. It implies helping the student to "computer-program" himself to handle life in all its aspects, to change, adapt, modify, accommodate, assimilate. It also suggests, not only the formation of particular programs, but also helping to formulate a master program which will enable the student to formulate his own programs.

More practically, the research pointed to the existence of individual differences in being able to internalize and control one's own behaviour through private speech. This might lead some day to the ability to diagnose these differences, and also to the realization that there may be specific ways to teach different children. Perhaps the different types may be able to handle different types of thought easier, as suggested by Kohlberg _et al_., (1968).

c) Summary and Discussion

Vygotsky's theory of the development of thought through language leads to the following theoretical perspectives. Language in any modality is important to the development of thought. Although both are separate in their roots, they become intimately related at an early stage. At first, the speech of others directs a child's behaviour. Later, the relationship is reflected in a child's talking to himself to guide his external behaviour. This private, self-directive speech, gradually becomes internalized, becoming inner speech which is the key to thinking. Speech in the form of internalized word meaning becomes an internal director of behaviour, so that now the child, by this thinking, regulates himself. Although most people use both inner and outer speech all their lives, the internalization is almost complete by age 10.

The development of concepts, based upon the medium of the word, goes through three main phases, the last and most important phase of true conceptualization being reached at adolescence. The means by which concepts are derived are two. The first are called spontaneous concepts, since they are achieved spontaneously and creatively out of one's experience, and are rooted in concrete facts. However, these have an inherent limitation, and can only rise so far. The second means of concept derivation is non-spontaneous, or scientific. This is a corresponding top-down development, refining the spontaneous, and using them in order to be applicable to reality. These scientific concepts are immediately generalizeable and abstract, being formed through the medium of instruction by language.

Educational implications are obvious. Adolescence is the prime time for academic advancement. This has been recently reinforced by Stanford Research Institute researcher Meridith L. Robinson, who stated that adolescents are "not...a bundle of pimply neuroses". Instead earliest adolescence appears to be a very fruitful time for academic learning (reported by Jack McCurdy, Times-Post News Service, in The Ottawa Citizen). The experimental results also suggested that language and instruction had a far larger significance than mere academic learning.

The stress on the necessity of scientific concepts pointed to the need for instruction as a means of developing thought. This could be subdivided into specific recommendations. Verbal intercourse, in which pseudo-concepts could be gradually refined into true concepts, was seen as a necessary stepping-stone. An important conclusion was the presentation of problems for the student so that he may advance using non-spontaneous concepts, which could then be refined through instruction.

The fact that language is important to the development of thought implied a return to a more "formal discipline" approach. It is as if inner speech becomes too condensed, and perhaps incomplete. There is a need for other language approaches in order to, in a sense, reprogram more completely the frontal cortex, and therefore have fuller programs by which inner speech could regulate all aspects of behaviour. This helps initiate a consciousness of being conscious, and therefore aids the student to rise above himself and conquer his past. A corollary here is the need for certain obligatory core courses, which would help develop thinking.

Other educational implications may be quickly summarized. The importance of individual differences was repeatedly stressed by the various disciplines. This leads to two future possibilities. One concerns diagnostic purposes. Perhaps more efforts should be placed in being able to find out which students are cognitively-reflective or impulsive (Save, 1973). Perhaps developmental norms could be established. This may be reflected in differential teaching methods. Some students may need more direct attempts to modify their own self-statements. Some may respond negatively to such attempts, etc.

Meichenbaum's and others' works imply specific remedial techniques for special problems. Perhaps students may be reprogrammed by self-statements to become more creative, attentive, and to overcome their impulsivity. Attitude, for example, may be the result of negative self-statements reinforced by failure, ending in a vicious circle. There seem to be some indications that self-statements and consequently behaviour can be modified.

In summary, there is ample evidence of the importance of the adolescent years in forming concepts, and the need to know how to go about this. There is a necessity for study and research into techniques of utilizing this critical period. Formal teaching seems to be of little value. The stress appears to be more on creating tasks which will lead into the child's possibilities; the theory also demands teachers be aware of the child's level of both spontaneous and scientific conceptualization, so that tasks can be created, and the concepts refined through instruction. A course which seems to be following this pattern in one particular area is that of Mr. B. O'Connor of Thomas A. Stewart Secondary School in Peterborough (reported in the Toronto Star, May 14, 1974, B3).

Although formal teaching yields little fruit except rote learning, task creating appears to need to be balanced by some form of formal education, that is, by courses which elucidate and refine the skills of inner speech. This is most obvious in the teaching of grammar, and of writing.

Vygotsky (1962) was well aware that the relationship of thought and language may only be a limited explanation of a complex fact. However, the door he opened should be of essential importance to any educator - the general problem of consciousness. "Thought and language, which reflect reality in a way different from that of perception, are the key to human consciousness" (p. 153).

4. Impact of Percepto-Cognitive Styles on Adolescent Cognitive Functioning

i. Developmental Trends in Perception

Earlier considerations of adolescent intellectual growth and capacity as well as the qualitative view of adolescent cognitive functioning and development have dealt with clear substantive issues in characterization of cognition. Interest in cognitive styles focuses on the manner or form typifying adolescent information-processing and problem-solving.

Study in cognitive styles is of a relatively recent vintage. During the last decade, a small but vocal group of psychologists researching cognitive processes have discovered sizeable and measurable individual variations in non-substantive, stylistic dimensions of cognitive development and behaviour. They contend that a full appreciation of cognitive functioning requires more than the ability to measure intelligence and identify qualitative characteristics of thought. In their judgment, equally important to an ultimate understanding of cognition and thought are individual variations in the style and form used in the interpretation, transformation, and reporting of information (Kogan, 1971).

There are definite indications that different dimensions of cognitive style are appreciably implicated in particular intellectual outcomes and adaptation to specific educational practices (Kagan et al., 1964).

Relationships between various dimensions of cognitive style and important behaviours such as vocational choice (Osipow, 1970) and pathology (Witkin, 1965) have been demonstrated.

Cognitive styles have been presented as dimensions in the manner of information reception, confrontation, solution, and management. Gardner _et al._, (1959, 1960) factor-analyzed several measures of cognitive styles, tests of mental abilities, and other personality indices, concluding that "...intellectual abilities and cognitive controls (styles) are not isolated aspects of cognitive organization, but are mutually interrelated. The arbitrary distinction that has sometimes been maintained between intelligence and the broad scale organization of cognition seems inappropriate" (Gardner _et al_., 1960, p. 123).

Research in cognitive styles has received its share of criticism. Ausubel and Sullivan (1970) contend that a serious methodological weakness common to studies in the area of cognitive style is the fact that the intra - and inter-task generality of function of the measures indexing cognitive style, its determinants, and functional consequences have not been established. This criticism is premature, considering the relative infancy of the area and a grossly unfair characterization in the case of well-researched dimensions like reflectivity, impulsivity and field dependence-independence. Absence of a broad body of replicatory research and cross-validation studies is more than offset by the many exciting observations of individual problem-solving variability and their educationally salient implications.

Students of cognitive styles would argue that given two children who exhibit similar IQ and mental age as well as having attained a developmental stage where conservation and transitivity in judgment is no longer a problem, there still will be consistent and distinctive dissimilarities in the way they think and the manner used to perform any given task. These inter-individual variations in style are reflected in perceptual organization of material, classification of information, and problem-solving behaviour, possibly influencing intellectual attainments and functioning.

Messick (1970) has provided a taxonomy of cognitive styles which reflects the rapid growth of this research area. Others have drawn attention to and have attempted to assess the effects of specific dimensions of cognitive styles on intellectual growth (Eagle, 1965; Kagan _et al_., 1964). Messick identifies nine cognitive styles, whose mutual interrelatedness or independence need to be assessed, but which have been labelled and studied by psychologists. The varieties of cognitive styles are presented in _Table V_ with an adaptation of descriptions provided in Messick (1970).

Kagan and Kogan (1970) contend that dimensions of cognitive style are influential at each level of problem-solving activity. They identify five processes as central to problem solving:

1) Encoding - selective attention to and perceptual preference for certain aspects of an event rather than other.

TABLE V

DIMENSIONS OF COGNITIVE STYLE*

COGNITIVE STYLE	DEFINITION
Field Independence	An analytic way of perceiving, ability to differentiate important elements from background by overcoming the embedding context.
versus	
Field Dependence	A global way of perceiving; inability to differentiate important elements in a problem.
Reflectivity	Analytic pondering of selected hypotheses; slow and deliberate evaluation of hypotheses and information-processing.
versus	
Impulsivity	Speedy response to problem, generally, the first answer which occurs to individual; frequently incorrect.
Scanning	Variation in the extensiveness and intensity of attention deployment; related to the vividness of an experience and span of attention.
Category Breadth	Consistency in preference for broadly inclusive or narrowly exclusive ways of categorizing.
Conceptual Styles	Individual variability in perception of stimuli similarities and differences in terms of many differentiated concepts; also includes the preferences for categorizing functionally or thematically as opposed to description and stereotype.

TABLE V (Continued)

Cognitive Complexity	Construing the world, particularly social behaviour in a multidimensional and highly discriminated way.
versus	
Cognitive Simplicity	Construing the environment in a simplistic and stereotyped manner.
Levelling	Meshing of similar though non-identical objects in memory, with corresponding difficulty in recall of similar elements.
versus	
Sharpening	Highly compartmentalized memory; distinctiveness of similar objects stressed with lowered tendency for confusion in memory.
Constricted Control	Low susceptibility to distraction and cognitive interference.
versus	
Flexible Control	High susceptibility to distraction and cognitive interference.
Tolerance for Incongruity	Individual variability in willingness to accept unrealistic experiences and perceptions at odds with conventional experience.

*Liberally adapted from Messick (1970).

2) Memory - information storage and retrieval functions.

3) Hypothesis Formulation - generation of alternative solutions to the problem.

4) Evaluation - the process of validating hypotheses by testing them against facts.

5) Deduction - attainment and implementation of solutions to the problem.

Perceptual organization and information-processing are key processes in this division. Since our selective review of two dimensions of cognitive style focuses on reflectivity-impulsivity and field dependence-independence, which have prominent perceptual components, developmental regularities in perception demand clarification. Gibson (1969) has supplied a number of generalizations which stress age-related developmental variations in perceptual organization.

She notes children demonstrate a decreasing tendency to react uniformly to stimuli of the same class with age. Fundamentally, specificity in stimulus discrimination increases while stimulus generalization decreases. Pick et al., (1972) compared second and sixth-grade childrens' Reaction Times (RTS) to visual stimuli with mixed properties. They found that their sixth-graders were more efficient and superior to second graders in deliberately focusing attention on discrete stimulus properties and less prone to distraction by irrelevant stimulus aspects. Maccoby and O'Neil (1970) noted a similar trend in selective use of verbal materials with increasing age.

Perceptual selectivity also increases with adolescents exhibiting a pronounced facility compared to younger children in attending to specific informational features against a noisy, complex background. Rand and Wapner (1969) compared the ability of eight and fourteen-year-old children to detect simple figures embedded in a strong gestalt. The fourteen-year-old children were singularly more adept at locating the figure than the eight-year-old. Maccoby's (1969) review of developmental trends in perceptual selectivity generally supports adolescent superiority.

Maccoby also notes, along with Gibson (1969) that information pickup becomes more economical with age, the child growing in the ability to perceive higher order structure of pattern inherent in stimulus properties. These perceptual developments bear a close relationship to the growth of formal operational thought. This economizing feature in perceptual development can be illustrated by the processes occurring in developing reading skills. Initially, groupings of letters within words are perceived as units, but with time, groupings of words into sentences develop.

Hagen and Hale (1972) reported a study utilizing middle-childhood and adolescent subjects which charted their performance on a task with central features and incidental features. They found significant developmental improvement in efficiency of attention deployment. Recall of the incidental task stimuli did not reveal any dramatic change from childhood through adolescence. However, task performance improved markedly. The difference was explained as a function of the older child's ability to inhibit attention to incidental task features and to concentrate on central task features. Additional support for the adolescent's ability to restrict attention and concentrate on task features central to solution was presented in the Siegel and Corsini (1969) study. They uncovered a curvi-linear relationship between age and incidental learning with a peak at age ten. Sheer amounts of incidentally learned materials were equivalent for their eight and fourteen-year-old sample, but different processes appeared to be involved. When relevant and irrelevant stimuli were conceptually related, recall of incidental features increased for the fourteen-year-olds and not for the eight-year-olds. Restricted attention would then serve to account for the performance of the younger subjects, but not the elder. They appeared to process the irrelevant information minimally. Siegel and Stevenson (1966) have noted similar age trends in the processing of incidental information.

With advancing age, decided shifts in preference for sensory modalities occur. Transactions with the environment for most children appear to pass through an initial preference for kinesthetic - motor during the early years to a visual and auditory modality during later periods (Bissell _et al_., 1971). Bruner _et al_., (1966) feels that this transition in modality preference is related to the manner in which children represent their environment in thought.

Shapiro (1966) reported that his ten and eleven-year-old subjects learned material better than thirteen and fourteen-year-olds when an auditory presentation was used. Senf (1960) found immediate memory for presentation of bisensory stimuli (visual and auditory) demonstrated improvement with age for visual items, while age differences did not emerge in auditory recall for his eight through fifteen-year-old subjects. Stevenson and Siegel (1969) discovered an emergence of preference for and efficacy in recall of material presented visually during adolescence. Comparing visual and auditory recall of third and seventh grade children, they found recall for visual content increased with age while recall of auditory content decreased.

Bissell et al., (1971) and Gibson (1969) observe that with increasing prominence of the visual modality in transacting within his environment, the adolescent exhibits increasing intersensory coordination and integration.

Within this framework of developmental regularities characterizing adolescent perceptual organization, two dimensions of cognitive perceptual style will be reviewed. Though many studies have been conducted to validate the dimensions labelled reflectivity-impulsivity and field dependence-independence, our energies will be devoted to a review and emphasis of those pieces of research which are either exclusively relevant to an adolescent population or which have some general implication for adolescent cognitive functioning and growth.

ii. Reflectivity - Impulsivity

Reflectivity - impulsivity, or conceptual tempo, refers to that dimension of cognitive style characterized by the manner in which the quality and validity of one's hypotheses are evaluated. Reflective children are deliberate and analytical in problem-solving activity and in their approach to new and unfamiliar tasks. Impulsive children are quick and impatient, seemingly thoughtless and failing to take sufficient time to consider the available information as well as possible responses to it.

Kagan (1965), studying elementary school children, observed that those identified as reflectives by a Matching Familiar Figures test (MFF) were capable of monitoring attention longer, were more persistent with difficult tasks, made fewer errors when beginning to read, and were less distractable and fidgety in classroom settings. Siegelman (1969) has developed a relatively similar profile for reflective adolescents in attention to visual stimuli. Ward (1968) reported that reflectivity-impulsivity is a general and pervasive feature of intellectual performance, consistent across tests and under different conditions. Impulsive children answer problems faster and are more prone to error than their reflective counterparts (Kogan et al., 1966). When faced with the visual comparisons tasks on the Matching Familiar Figures (MFF) test, reflective children spent more time examining alternatives than the standard stimulus. They appeared to compare alternatives and only then consulted the standard for verification or rejection of the alternative. Impulsive children, on the other hand, compared the standard with one alternative at a time, making decisions on the basis of how similar or how different the standard was from the alternative. They did not respond to differences in detail, responding quickly and making significantly more errors than reflective children.

Nuessle (1972) compared reflective to impulsive fifth and ninth-graders in their information-processing proficiency (focusing) on a concept identification task. He found the reflectives better able to eliminate irrelevant hypotheses. In addition, reflective children demonstrated longer latencies following feedback than impulsives, particularly if the feedback was negative. Lee, Kagan, and Rabson (1963) found that reflective and impulsive third-grade boys learned relational and analytic concepts differentially. The time required for learning analytic concepts was shorter for reflective than impulsive boys, while the reverse observation was true for relational concepts. Unfortunately, to date there have been few studies of the validity of this observation for an adolescent sample. In fact, there has been a fairly general disregard of studies in adolescent reflective-impulsive behaviour.

Kagan and Kogan (1970) contend that conceptual tempo is bound by two major developmental principles. For one, differences in conceptual tempo are detectable as early as two years of age (Repucci, 1968; Pederson and Wender, 1968).

Another clearly evident trend is increasing reflectivity through adolescence and beyond. However, a clear possibility exists that some children are reinforced for impulsive behaviour and do not exhibit the more common growth in reflectivity (McCandless and Evans, 1973). Typically, a teacher's reinforcement of speed of response rather than accuracy may be the critical variable (Kagan et al., 1966).

Evidence for increasing reflection with age was gathered by Draguns and Multari (1961) who presented grades 1, 3, 6, and 7 children with ambiguous pictures and who by providing additional elements progressively decreased the ambiguity. Younger children were more likely to guess earlier in the procedure, whereas the older children inhibited guessing until they were reasonably certain of being accurate. It would appear that developmental increase in reflective strategy may well be an outcome of a general disposition to be cautious with age and to be concerned with making errors. Increasing reflectivity with age has been reported by Kagan and Siegel (1963) as well as Westcott (1968) thus confirming the earlier study by Draguns and Multari.

Olver and Hornsby (Bruner et al., 1966) point out that while there is a demonstrable general tendency toward reflectivity in evaluation of problems, the nature of the task moderates this trend. Comparing the use of analytic and functional concepts in response to pictures and words, they found analytic concepts decreased while functional concepts increased with age. In addition, analytic concepts were more likely to be used with pictures than with words. Siegel and

Olmstead (1967) found elder children produced more analytic responses for all classes of stimuli-people, objects, or animals.

Task mediation of reflective-impulsive expression was observed in the study by Kagan et al., (1964). When the degree of uncertainty in a task increased, impulsive children were prone to make mistakes which resulted in some combination of erroneous learning, disapproval and criticism from others. Such tasks as arithmetic are particularly difficult for the impulsive child. Reflectivity may often have drawbacks as well. Messer (1970) found reflective children were more anxious about making errors and displaying incompetence when faced with reasoning problems than impulsive children.

While overall reflectivity does not appear to be affected by sex differences, Kagan, Moss and Siegel (1963) found boys were more likely than girls to be over-represented at both extremes of the reflectivity - impulsivity dimension.

Evaluative judgments of either reflectivity or impulsivity should be witheld, unless qualified by the nature of the task of activity through which the style is expressed. Unfortunately, it is commonly true that adults often are deceived by appearances, preferring to think the impulsive and quick child to be "brighter" than his reflective peer who takes more time to organize and reflect on his responses. Teachers are particularly prone to such logical rating error, and their judgments of the child's intelligence are based on his style of responding rather than intellectual ability (Alexander, 1953).

While the analytical reflective style is beneficial in tasks requiring mathematical and clinical dissection, the impulsive child is more likely at an advantage in humanities, social sciences, and art (Kagan et al., 1964).

The effect of conceptual tempo on intellectual performance has yet to be unequivocally demonstrated. Kagan et al., (1966) have arranged programs for modification of conceptual tempo by tutoring impulsive children to become more analytical in their responding. Though instruction affected speed of response to problems, it failed to produce any noticeable improvement in their intellectual performance, i.e., change IQ scores. However, Yande and Kagan (1968) presented evidence that a modelling procedure is of significant value in changing a child's conceptual tempo. Exposure to a more or less reflective teacher and teaching style, along with a pattern of verbal reinforcement for reflective behaviour produced measureable changes in conceptual tempo.

iii. Field Dependence - Field Independence As a Cognitive Style

At many different levels and within various content areas, education requires students to make a relevant cognitive response to problems which often represent perceptually complex situations. Herman Witkin and his associates have identified and attempted to explain individual differences in cognitive style whereby relevant features of a situation or problem are distinguished and extracted from irrelevant features. They have labelled this dimension of cognitive style field dependence - field independence, or psychological differentiation. Field-independent or psychologically differentiated individuals are adept at separation of the essential and salient features of stimuli from their general context. At the other end of the differentiation continuum, the field-dependent person reacts to the complex situation as a whole, without analyzing it, and responding on the basis of what the situation does to him rather than what he does to it. For example, when given a complex or noisy problem where the key elements to solution are camouflaged by extraneous data, the field-independent is more likely to perceive the elements and does so more readily than the field-dependent. In one sense, the field-independent handles the problem while the problem overcomes the field-dependent.

Witkin *et al.*, (1954, 1962) developed four major procedures for assessing variation in psychological differentiation. These measures offer a clearer illustration of the differences characterizing field-independent and field-dependent persons.

The initial technique is the *Body Adjustment Test* (BAT) which requires that the subject sit in a movable chair placed in a small, equally mobile room. Both room and chair can be tilted in the same or opposite directions. Once the person has been moved into some position where his seating is some angle removed from the true vertical, he is given control of the instrumentation governing chair movement and attempts to restore his body to a true vertical position. His score on the *BAT* is obtained by measuring the angle of absolute deviation from the true upright position. The smaller the angle, the greater his field independence or differentiation. Accomplishing this task is interpreted by Witkin as the ability of the individual to divorce his visual sensations from kinesthetic cues to uprightedness and responding to the kinesthetic.

In the *Rod and Frame Test* (RFT) the subject is seated in a completely darkened room facing a luminous rod suspended within a luminous frame. Both stimuli are movable and can be tilted to any angle the experimenter desires. The subject's task is to readjust the rod to an upright position, without regard for the tilt in the frame. As in the *BAT*, his score is determined by the angle that the rod deviates from a true upright or vertical position, and also represents an ability to differentiate kinesthetic and visual cues.

The third test consists of a series of geometric shapes camouflaged within a complex design and is called the *Embedded Figures Test* (EFT), deriving in large measure from an instrument developed earlier by Gottschaldt (1926). The subject has to pick out and outline the form of a simple geometric figure which he is shown and that can be found somewhere within the more complex configuration. He is timed in the performance and instructed to work as quickly as possible with the 24 different test problems. His score is simply the sum of the time measures. A significant portion of the visual stimulation he receives, the colours and other shapes within the overall configuration, must be effectively overcome in order to identify the simple geometric shape. His ability to isolate the test form, rather than reacting to the complex as a whole, is reflected in the speed of response. This measure of psychological differentiation is the most economical to use and score.

The final method for measuring psychological differentiation is the Articulation of Body Concept (ABC), which merely requires that the subject draw a person, and after completing that drawing, draw another person of the opposite sex. The drawings are then evaluated according to a comprehensive rating system which takes into account the appropriateness of detail in the sketches, and sophistication in articulating the human form. The field-independent is identified by the clarity of the differentiation in the parts of the human body and the manner in which the parts are juxtapositioned.

The common theme underlying performance on these different measures is the manner in which an individual deals with confusion, whether by being able to separate aspects of confusing situations from their context or falling victim to their perceptual press. Witkin *et al.*, (1954, 1962) reported an astonishingly high interrelationship between performance on these different measures. Field-independents as assessed on the BAT were more likely to identify the simple geometric forms in the EFT than field-dependents. In addition, high field-independents were superior at drawing persons in a manner demonstrating clear articulation of the body concept.

While criticized for arbitrarily instituting psychological differentiation as a cognitive style rather than a special ability (Zigler, 1963; Witkin et al., 1962) contend they are justified in labelling psychological differentiation a cognitive style. Zigler's (1963) accusation that the significant correlations obtained between measures of psychological differentiation and IQ reflect the operation of nothing more than a general intelligence factor, was neatly countered by Witkin's et al., (1962) factor analysis of the WISC subscales which correlate with their measures of cognitive style. They demonstrated that the WISC subscales correlating with their measures required the subject to overcome an embedding context. These subscales included Picture Completion, Object Assembly, and Block Design. Verbal and other performance subtests were unrelated to psychological differentiation. Performance on the three related subscales may be dictated by cognitive style rather than intelligence.

Numerous validation studies of these instruments measuring psychological differentiation have demonstrated a host of relationships and predictions of various behavioural and personality traits. Field-independent and field-dependent individuals tend to be different kinds of people. Field-independents tend to actively deal with and manipulate their environment while field-dependents seem to accept their environment passively, reacting to it in a global and intuitive fashion (Witkin et al., 1962). Deep-seated personality dispositions, such as the defensive structures used to cope with their environment, reveal equally different mechanisms for field-independents and field-dependents. Proposing that children with an analytic approach would be more likely to employ intricate and specialized defences such as intellectualization and isolation while field-dependent children tend toward simple, primitive defences such as repression and denial, the Witkin group evaluated a sample of 10-year-old boys by blind analysis of three projective tests. Ratings of their responses on defensive structure when correlated with the perceptual-index scores (a composite of performance on the major tests for psychological differentiation)yielded a highly significant $\underline{r}$ of .61, suggesting that the complexity of defensive structure increased with increasing differentiation.

Crandall and Sinkeldam (1964) reported a relationship between achievement orientation and field independence in their sample of children aged 6 through 12, whereas their prediction of dependence-seeking social behaviours and field dependency did not hold up.

Konstadt and Forman (1965) experimentally examined the effects of field dependence on dependency-related behaviours to find that their sample of fourth-graders who were field-dependent performed more poorly under conditions of disapproval relative to approval than the field-independents. The field-independent child seemed to be less externally directed in his activities, while the cognitive and affective behaviours of the field-dependent child were highly contingent on the position or negative social cues emitted by others.

The question of developmental stability in psychological differentiation has been addressed by study of two longitudinal groups (Witkin, Goodenough and Karp, 1967). One group was tested at ages 8 and 13, while the other was tested at ages 10, 14, 17 and 24. Overall, the test-retest correlations of the measures revealed a high probability that a preadolescent who is either field-independent or field-dependent will maintain his status through young adulthood. The coefficients of stability ranged from .48 through .92. While these measures supported a relative constancy of psychological differentiation over time, the absolute level of psychological differentiation increased through age 17 followed by a slight decline through age 24. Witkin and his associates were particularly struck by the manifest stability in psychological differentiation over the ten-year period studied. They argued that any measured dimension of personality which exhibits such a high degree of stability during as turbulent an era of development as represented by these ten years is comparable to the observed stability of IQ. Kagan and Kogan (1970) point out that this argument should be qualified by the observation of increasing field independence with age, indicating intra-individual variability in psychological differentiation. Faterson and Witkin (1970), in a separate longitudinal study of the body concept test (ABC) produce supportive results for the stability of psychological differentiation from 10 through 24. Ratings of drawings made by their sample over these two age periods correlated .78. Unlike the Witkin et al., (1967) study, they found improvement in psychological differentiation as measured by ABC to be negligible following age 14.

Maccoby (1966) has summarized studies which review the role of sex differences in psychological differentiation. In the main, boys are more likely than girls to score higher on field independence. This difference emerges in the middle years of elementary school and is non-existent before that developmental period. Sherman (1967) has argued that this difference can be attributed to differential cultural opportunities offered males and females to engage in activities and games emphasizing spatial skills. While this position has some minimal support (Vernon, 1972),the overall consensus of opinion challenges the role played by learning experiences in the development of a global or analytic style.

While the theoretical implications of Witkin's research are multiple, its implications for educators are equally extensive. Witkin seems to have uncovered an area of intellectual functioning which has been generally ignored in favour of verbal and numerical skill. Educational agencies should capitalize on analytic skills rather than restricting their enterprise to the development of verbal and number capacities. Significant evidence exists that culturally disadvantaged and culturally primitive group members do not differ in field independence widely from groups having access to broad-based educational opportunities (Witkin, Faterson, Goodenough and Birnbaum, 1966) and may in fact be in some instances superior in analytic skills to the more advantaged groups (Harris, 1963; Vernon, 1965).

Field-dependents, on the other hand, cannot be discharged as less socially useful and relevant. Evidence is offered from many sources that field dependence is correlated with greater alertness to social stimuli, exhibited in the field-dependent's superiority in retention of social words (Fitzgibbons, Goldberger and Eagle, 1965), ability to achieve unanimous consensus in less time on problem-solving tasks than field-independent groups (Wallach, Kogan and Burt, 1967), and general expertise at the art of interpersonal accommodation.

5. General Conclusions and Recommendations for Educational Practice

Many utilitarian issues have been raised by the preceding discussion of adolescent cognitive functioning. While most of the normative data reviewed have been based on studies conducted by the purist, the scientist, educational practitioners demand answers to pragmatic questions such as "How are these disjointed facts and the voluminous body of data concerning adolescent cognitive functioning adaptable to maximization of curriculum impact and effectiveness?"

Answers to questions of this nature are varied and equivocal. The transition from empirical research to application and the implementation of practical programs is neither tidy nor direct. At best, a limited number of generalizations can be offered as broad guidelines for evaluation of currently instituted educational policies and practices and their applicability to the cognitive characteristics of the early adolescent. Any changes in educational practice based on these generalizations should be empirically evaluated for utility before program implementation.

While both the quantitative-qualitative orientations toward the study of early adolescent cognitive functioning have contributed extensively to our understanding, the utility of the information for the educator is difficult to determine with any degree of precision. The psychometric view tenders a description of intellectual abilities and intellectual growth in terms of scores on mental tests while the qualitative-developmental view has broadly characterized the state of formal thought and its correlates.

The psychometric approach has established that adult intelligence as measured by commonly used mental test devices is developed to more than fifty per cent of capacity by the time the developing individual is 10½ or 11 years of age. This age approximated the initiation of early adolescence. Mental growth rate, which to that point has been positively accelerative, starts to slow down. Consolidation of intellectual ability and elaboration of specific cognitive abilities is marked during this period rather than continuing acceleration. Late adolescence and the years beyond bring with it adult social and economic concerns with a corresponding decrease in intellectual development, particularly for those who choose not to pursue or are denied further access to education.

Overall intelligence is subordinated to the development of specific mental abilities. The notable differentiation of cognitive abilities makes its first measureable appearance during early adolescence. Perhaps dictated by the adolescent's idiosyncratic interests and attitudes which are ever-broadening with age and experiences, abilities become diverse and varied. Variability between and within specific mental abilities over time is common, making curriculum planning a difficult and hazardous activity when dealing with groups of heterogeneous adolescents. Differences in mental ability are reflected in academic achievements. For example, males who generally score higher, for whatever reasons, on scales of spatial and mathematical reasoning, do significantly better in mathematically based course work, whereas females, who generally outscore their male counterparts on verbal scales, do significantly better in courses requiring reading and comprehension skills. These differences should be accommodated in curriculum planning. Educational tasks which allow a significant flexibility in choice and difficulty of content may maximize the educational function. While granting the necessity of teaching a basic course which combines the various skills needed to survive the social and economic demands of a modern world, the educator would be best advised to allow intellectual propensity to guide learning rather than demanding too much or too little from the respectively slower and brighter student in a given ability.

While differentiation of ability with synthesis and consolidation of intelligence seems a fairly well-established principle of intellectual development, somewhat equally but reservedly stability of IQ over time has been supported in a broad sense. Many researchers have provided empirical demonstrations of extremely wide fluctuations in IQ over time, while generally the IQ constancy hypothesis holds. This general characteristic of IQ has possibly done more educational harm than good, for consistency of IQ is accorded an infallibility which severely under or over-estimates a student's growth in mental ability. Not only is selection of children for special classes or placement based on IQ test results less than democratic but it lacks scientific support. IQ does change and the growth rates of IQ for individuals are not continuous and systematic.

Individual uniqueness of mental growth-rate patterns is more the rule than the exception. While composite indices are characterized by growth following a relatively continuous negatively accelerating trend, individual ability in mental growth-rate is prominent. Some children demonstrate a heightened quickening while others slow down dramatically. Other individual rates are characterized by periodic spurts with plateaus during which growth rate is seemingly nonexistent. These individual trends are not only reflected in overall intelligence but in the specific mental abilities which define overall intelligence.

Children and adolescents assigned to grade levels by age demonstrate varying degrees of academic achievement within their school milieu. Flanagan (1965) in a national survey conducted in the United States known as Project Talent observed that 25 to 30 per cent of his ninth-grade sample surpassed the average twelfth-grader in achievement on most common school subjects. Within a given age-graded classroom, the twelfth-grade, the top 5 per cent of the students learned twice as many foreign language words in a given time period than the average twelfth-grader. Differences between the extremest groups in comprehension of literary passages identified an enormous gulf favouring the top 5 per cent of the twelfth-grade group who were capable of recalling eight out of ten items of information while the lowest five per cent could only average two.

These observations dictate that any uniform or quasi-traditional approach to teaching and instruction which does not accommodate individual ability differences probably fails to encourage the most intelligent and capable students as well as the less capable child, possibly restricting the educational progress of both groups. If education is to progress, it must take into account these variations in cognitive functioning.

Individualized, modular instruction appears to be a major direct implication of this research for the educational practice. Differential mental growth rates and variations in cognitive ability dictate that the adolescent be presented with a smorgasbord of educational resources and materials which allow him some leeway in working at his speed while still challenging him to improve and attain higher levels of functioning.

While the foregoing general educational implications of the quantitative studies of adolescent intellectual development should be reflected in the construction and refinement of curricula, a number of specific recommendations can be made. They are offered cautiously and with the expressed reservation that qualifications should be considered at the very least and sound evaluative research at the best before attempts are made to predicate curriculum change on their basis.

1. The overall generalization that the older the adolescent, the greater his learning capacity, holds up rather well under examination.
2. Early adolescence represents the beginning of cessation in mental growth, an age when performance on measures of mental ability exhibits a negatively accelerating trend. Real growth continues, but at a slower rate, suggesting a consolidation phase within developing cognitive abilities rather than in their multiplication.
3. Mental growth during early adolescence demonstrates a measureable differentiation of ability with overall or general measures of intelligence that are less predictive of performance in specific content areas than are tests of primary mental abilities.

4. Individual adolescents' mental growth rates are highly variable, with some exhibiting tremendous surges in mental growth, others essentially stable, while still others exhibiting a decrement. In addition, some combination of these trends within one adolescent's mental growth is also possible.
5. Intelligence test scores are reasonably reliable and valid predictors of the adolescent's ability to master verbal and quantitative materials. However, other forms of performance, e.g., novel and creative manipulation of materials and mechanical or motor ability, are not equally predictable on the basis of IQ.
6. As the time between IQ testing and performance on achievement measures in various academic content areas is increased, IQ is less predictive of performance.
7. Prominent sex differences in ability to grasp certain content areas emerges during early adolescence. Boys are much more adept at spatial and mathematical tasks, while girls are demonstrably superior on verbal tasks. This may reflect social sex-typing of interest rather than true difference in mental capacity.
8. During adolescence, boys are more likely to be IQ gainers than girls, (partially explicable as the social reinforcement of competency strivings in the male).

9. With increasing age during adolescence, the individual becomes more important in shaping his mental development than was the case earlier.

The Piagetian approach to study of cognitive development would generally instruct the educational practitioner to modify his methods of instruction so that they are attuned to the patterns of thought which are natural to the child at the age considered. While this does not mean that one will be able to teach the child anything if his approach is correct, it does mean that you could teach him more than anyone may have guessed. Each developmental stage should be characterized by different educational approaches considering the massive gulfs characteristic of thought between stages.

Early adolescence initiates the stage of formal operational thought, ostensibly a final development in cognitive growth; final, in the sense that the formal-operations child acquires the capacity to think in abstract terms--like a scientist--no longer relying on direct experiential and concrete contact with the elements which represent thought contents. More adult-like forms of information-processing and problem-solving make their appearance to one degree or another during this stage. Personal hypotheses become responsive to the evaluation of data. When the formal-operations thinker is faced with a conflict between sense data and his own convictions he is flexibly prepared to allow the data to modify his personal hypotheses rather than holding them tenaciously and dogmatically. Appreciation of combinatorial logic and realizing the exhaustiveness of all possible combinations of elements allow the early adolescent to systematically and progressively solve problems to their logical conclusion. Purely chance or trial and error approaches to problem solving diminish in frequency and strength.

Use of chronological and historical concepts demonstrate an awareness of past and future time perspective. This development reaches fruition quite late in adolescence, at approximately sixteen years of age, signalling the adolescent's readiness to understand and handle biblical, mythological, historical, and future references in greater depth and clarity. Concepts of quantity: volume, mass, and weight become more meaningful as well, allowing the adolescent to grasp basic physical laws which utilize these concepts. However, these concepts are not each fully developed at the same time as was noted by Elkind (1961). Overall, there is a demonstrable difference in the formal-operations child's ability to be flexible, inventive and controlled in his thinking.

The appearance of these qualitative changes in thought is not spontaneous or full-blown. On the contrary, it is characterized by gradualism and individual rates of development. While the development is achieved at approximately the same age for most adolescents, individual difference variables appear to exert some impact on the transition from concrete formations to formal operations. In addition, the area of cognitive content seems to dictate the transition from concrete to formal operational thought, with certain propensities being acquired later than earlier in the process.

According to Piaget, direct environmental intervention has little impact on accelerating transformations in the qualitative dimensions of thought, and may in fact be deleterious if so applied in teaching. This does not mean that environmental arrangements do not affect development of cognitive structures, but that the effect is in part a natural biological progression partially contingent on incidental, culturally mediated learning experiences. Structuring of the environment and thereby treating the child as a passive element in the learning process to accelerate cognitive transformations is misdirected and ordinarily ineffective (Flavell, 1963; Phillips, 1969). Only rarely does Piaget consider the educational implications of his studies, preferring to chart and empirically develop what is fundamentally a philosophy of cognitive growth. Educational pragmatism and applied psychology are viewed as "American questions".

Nevertheless, a limited number of broad generalizations which have utility in educational practice can be gleaned from the Piagetian position on development. The general axiom, stated at the outset of this section, bears repeating. If the child is developmentally capable of certain operations, then educational methods should be modified to accommodate his cognitive capabilities. Just as one cannot expect a child who has not mastered standing upright to walk, so one cannot expect an early adolescent who is incapable of abstraction to capture the metaphorical meaning of Alice in Wonderland. Equivalently, an adolescent caught up in the present time perspective would not be expected to appreciate the historical growth of nations.

Another generalization which is notably one of Piaget's rare references to classroom teaching, suggests that each set of concepts or concept which is acquired has to undergo the processes of accommodation and assimilation in stage-wise sequences from the sensori-motor through the formal operational level of thought. Fundamentally, the teacher would be urged to recapitulate the developmental sequence necessary for the acquisition of a concept by introducing the child to its sensori-motor properties, then having him perform the necessary operations with the materials, reflecting on the materials and cognitively anticipating other operations which can be performed, and so on, until the child internalizes the operations and can reproduce them without depending on the environment (Flavell, 1963). Unfortunately, this procedure is highly inefficient from the standpoint of educational practicality, since it ordains that each concept be taught using a sensori-motor through formal operational form of instruction. For example, teaching a basic principle in mechanics would involve sensori-motor experiences with instances of the principle through pre-operational and concretely-operational mastery terminating in some appreciation of the principle at a formal level. Concepts which may not have concrete identifiable referents such as time, democracy, and on, would be particularly difficult to teach using this method.

A related generalization, based on Piaget's notion that teaching a child something interferes with his opportunity to re-invent it personally, has been incorporated into a teaching technique developed by Suchman (1964) which he labels Inquiry Training. This procedure assumes that the child is the master of his cognitive destiny. That is, if the environment is open to him and he is capable of acting on it, he will try to invent his own cognitive structures which allow integration of all the information in the environment. The teacher in a classroom setting, as part of the environment, should not assume a directive or synthesizing stance in manipulating cognitive growth. Rather, his role should be fundamentally that of a resource which the child can use or which stimulates the child to evaluate his own thinking about phenomena. Less direct tutorial activity is indicated for the teacher, more active searching for the student who is made to realize that the teacher is available to him as an aid in finding answers. Effectively, the student becomes a more important factor in his own cognitive development than most traditional instructional approaches would allow him to be.

While attempts to apply Piaget to the classroom abound, a common complaint of many practitioners rests in the difficulty they have identifying the individual adolescent's level of formal operational thinking. This limitation is imposed by the absence of any convenient measure of Piagetian concepts. In an attempt to eliminate this hurdle, a number of researchers have attempted to wed psychometrics and Piagetian data. Their success to date is somewhat mute, but holds promise for the near future. At the University of Montreal, Pinard and Laurendeau (1964) have initiated a program of research designed to produce a scale of mental development based on Piaget's theory. Their approach involves the welding of the Piagetian flexibility and thoroughness in questioning with a standardization of the questioning. To date, their success has been moderate (Pinard and Sharp, 1973). A particularly unfortunate dilemma is the uncommonly long time that it takes to test one student. During the standardization studies for this instrument, each subject was tested for practically ten hours. Hopefully, refinement of the measuring instrument will solve this problem.

The initial embryonic attempts to apply Piagetian theory have been promising and work should continue in this vein. The voluminous body of data generated by the Geneva School should be exploited fully by the applied psychologist and educator for its long-range consequences for society and the modern world are enormous.

It was with much trepidation that the following specific recommendations for education are offered based on this review of the Piagetian view of cognitive functioning. The unease is created by Piaget's own lack of interest in the educational implications of his theory. Nevertheless, an attempt will be made to deal with pragmatic issues, for nothing is more practical than a valid theory for making policy decision, and few can argue against the soundness of Piaget's description of adolescent cognitive development.

1. During early adolescence, management of abstract and hypothetical concepts emerges, thereby facilitating the teaching of general principles. Less emphasis on concrete instances of a principle is indicated than for a younger age group. This does not mean that pure abstractions will suffice, but rather that such explanations of phenomena need less concrete buttressing.
2. Since the adolescent becomes more facile at problem solving given the needed information and materials, the teacher can effectively maintain a low profile in the classroom, being less directive and obtrusive in the adolescent's activity and assuming the role of another resource for the student's problem-solving.
3. Given the broad outline of a problem, with all of the essential elements present for its solution, the formal-operations child or adolescent is capable of working within the problem's constraints centring his problem-solving activity on the relevant elements and less distractable from the pursuit of his goal.
4. A principle acquired with one set of materials is readily generalized to another set of materials provided they are fundamentally similar. For example, a basic law of mechanics which is acquired in one situation will be applied to the movement of particles in another situation.

5. Personal hypotheses challenged by empirical data, are evaluated and considered by the formal-operations child or adolescent. If the personal hypothesis is found not to help, it is flexibly revised in the light of this evidence.
6. Metaphorical content of literary materials is slow to be appreciated by the early adolescent. With increasing age, the adolescent is capable of going beyond the literal meaning.
7. Historical, mythical, biblical, and autobiographical materials are difficult to understand for the early adolescent with appropriate appreciation of such contents developing at approximately 15 years of age. These difficulties are primarily the result of the relatively late developing understanding of the concept of time.
8. Conceptions of law and political systems are equally nebulous during early adolescence, becoming more refined and differentiated at approximately 15 to 16 years of age. Prior to that time, authoritarian solutions to societal problems are expressed with a patent inability to appreciate democratic views and civil rights.
9. While concepts of quantity are generally well developed during adolescence, volume concepts appear to be particularly difficult to grasp prior to age 18. Overall, boys are more capable than girls in handling quantity concepts, and more intelligent adolescents are more capable than less intelligent adolescents.

10. Emergence of formal operational thinking exhibits a fair amount of individual variability as well as differential development dependent on the content area.

Some recommendations for the educational utility of various cognitive styles can also be offered. These are:

1. Differential processing of information is reflected in the adolescent's academic achievements. Certain styles are more functional with quantitative than verbal materials and vice versa.
2. Cognitive style dimensions, particularly psychological differentiation, appear to be relatively stable aspects of personality, changing little with development.
3. Psychological differentiation, or field independence increases through adolescence. Reaching peak growth at approximately 17 years of age, the pattern and stability in growth is highly similar to the growth of intelligence.
4. Field-independent adolescents are more proficient in spatial and mathematical tasks, while field-dependents demonstrate superiority in tasks loading high on verbal and emotional content.
5. Field-dependents are more adept at problem solving with a group setting, attaining consensus more rapidly than field-independent groups.

6. Reflective children are better able to manage science and mathematics while impulsive children are more suited to humanities, arts, and literature.
7. Impulsivity can be controlled by appropriate instruction in problem solving and teacher exhibition of reflective-analytic approach.
8. Impulsive children make more mistakes in problem solving and are much quicker than reflectives in arriving at a solution.
9. Field-independent children are not easily manipulated by social approval or disapproval of performance, while field-dependents are highly reactive.
10. Under pressure to perform, reflective children demonstrate significantly higher anxiety than impulsives.

4

Empirical Base for the Emotional and Social Development of Normal Adolescent

1. General Introduction

The central event of adolescence is the development of the reproductive capacity, an event which has an all pervading effect upon the individual and his social environment. Vast changes, some sexual, others non-sexual, are anticipated in this period. In addition to major biological changes, there are concomitantly important developments in the psychological and social areas.

The purpose of this chapter, in particular, is to review the empirical base in the literature for the emotional and social development of normal adolescents. It is undertaken and designed to provide a wide base of up-to-date information to be used for meaningful educational planning. The review will also serve to identify needed areas of research for a more thorough and comprehensive understanding of normal development during adolescence.

To serve as a meaningful base for study and discussion of the educational needs of adolescents, ages 12 to 16, this review has been purposely broad, encompassing a large repertoire of theories and empirical evidence accrued through diverse methods of inquiry. Consequently, there will be at times apparent inconsistencies and conflicting interpretations due to the differences in theoretical formulations or methods of research employed in the respective studies. Where this does occur, an effort has been made to insure that opposing views or conflicting findings are equally represented in a factual manner. The intent throughout this study is to assemble a broad information base which may be subjected to interpretations from a variety of theoretical points of view.

There is surprisingly little empirical research available on the developmental patterns of normal adolescents. There is an extensive literature, however, which has devoted much attention to adolescence but from a point of view drawn from observations of behaviour of a small segment of the total adolescent population. Attention has been focused primarily on behaviour of those found in clinical settings, from which generalizations have emerged on the behaviours of the larger majority of normal adolescents. It is small wonder then that adolescence has been stereotyped as a period of turmoil. The unusual, the bizarre and the atypical have served as the model from which to extrapolate norms. Fortunately such practices are being seriously questioned today (Offer, 1969; Gold and Douvan, 1969) as legitimate sources for modal patterns for the majority of adolescents. As more stress is placed on systematic empirical study of normal adolescents themselves, the image of adolescence changes from one of "sturm und drang" to modal patterns that are bland by comparison. Research reveals an image of adolescence that is much more tranquil and stable for that majority than the picture conjured up from theories based on clinical experience and current social comment.

This search of the literature has been directed to a large extent toward studies of the most numerous group. It has incorporated also a recognition of exceptionality within a normal range, which will enevitably surface in terms of individual and cultural differences, and a method of accounting for it. Severe deviation, serious delinquency or the pathologically disturbed, are excluded. Reports and studies which are preoccupied with clinical conditions have been kept at a minimum, but not excluded entirely. Some such studies find their way into reviews, pronouncements and major treatises of prominent theoreticians we cannot ignore. Priorities in the search of the literature for normative data have been ordered as follows:

1. Empirical studies of the most numerous group completed in the years 1967 to 1974.
2. Major textbooks on adolescence published since 1970.
3. Major empirical studies of the 50's and 60's which are identified in the major texts on adolescence.
4. Statements by leading theorists, such as Erikson and Piaget.
5. Major books of the 40's--principally to serve as a source for tracing major changes in the last 40 years.

As an initial point of departure, studies were sought that had some bearing on those developmental tasks of adolescence pertaining to emotional and social development. There are a number of excellent statements on developmental tasks, principally those of Havighurst, Erikson, Super, Zaccaria, and Gordon, who have proposed useful models. The Group for the Advancement of Psychiatry (1968) identified certain universal tasks of adolescence. These tasks transcend cultural differences and are assumed to apply to all individuals. They are universals based upon the fact that man is a learning animal and that all adolescents must learn. What they learn may differ from situation to situation and culture to culture. Since adolescence in all cultures is a period marked by significant change from one who is nurtured to one who is expected to provide nurture for others, each adolescent will be expected to learn how to work and how to love. If biological needs and drives are essentially the same throughout the species, the universal problem then is that of society fitting the new organism into the older cultural context. Thus, the individual may achieve discipline over his basic drives and become an integral part of the societal pattern. The so-called "stress and storm" of adolescence considered by some to be based solely on biological origins, appears to be differentiated to a large extent by the pressures and demands of a respective culture. For example, in the Samoan culture adolescence is observed to be relatively free of stress. In Western civilization, any consideration of the adolescent must be aware of the Judeo-Christian influence as a prime cultural conditioner of the adolescent.

A synthesis of these viewpoints provides a convenient perspective of normal development for the purposes of this study. The import of the information brought together here is heightened if it is seen on the background of those imperative behaviours that an individual must develop during adolescence if he is to fuse effectively with the mainstream of contemporary society. Normal development will occur to the extent that the adolescent accomplishes these developmental tasks. In the few short years between childhood and adulthood the boy or girl must:

1. Achieve an appropriate degree of independence from his/her family,
2. Adjust to his/her sexual maturation,
3. Develop new and cooperative relationships with peers that will encourage emotional independence,
4. Develop a philosophy of life that is consistent with the realities of existence, and
5. Make some basic decisions fundamental to fulfilling adult responsibilities to other oriented values.

These tasks arise from the maturational needs of the individual and the demands of the society.

The schema of this report has been organized with the thought of presenting a wide array of diverse materials in a pattern that will readily facilitate varying degrees of study. It will also identify areas deficient in facts and inconsistencies and contrasts in data where more research is needed.

Discovering the normal can be beset with a number of difficulties. Normality may be described in some instances as help, in others as utopia, in still others as average or as process. As the term is used in this study, we are trying to identify that behaviour which is characteristic of the most numerous group within the given population, maintaining at the same time some provision for exceptionality within a normal range. The term normative expectations will be used herein to describe two characteristics:

1. A modal behaviour for the most numerous group, and
2. Concomitant variations for minor substructures within the population.

The modal behaviour is what we can expect or what has been found to be the typical behaviour of the average adolescent.

Normalcy is not reserved to his behaviour alone, however. Variations in cultural and maturational conditions may dictate a variance which can be taken as quite normal for a subgroup. Thus, each modal behaviour is only complete when tolerances have been indicated for differences. Again this does not imply that extreme deviation or pathological conditions are normal--those conditions statistically represent a very small per cent at the extreme ends of a continuum.

In this study, we have arbitrarily identified the adolescent of the North American middle-class culture as exhibiting the behaviour we have classifed as modal behaviour. Once the modal behaviour was established, we endeavoured to identify variations that may occur through sex, age, and socio-economic conditions. Although, in a general way, race and possibly other influential factors have not been ignored, because of the special aims of this report they have not been reported as major variances.

Middle-class culture has been taken as the point of origin for the identification of modal behaviours for these reasons:

1. It is far more widespread in North America, and has a more profound effect on a greater number of people than any other subculture.
2. There is much more reliable information available on this group. Major landmark studies have concentrated on this area.
3. Subcultural mores on close examination show that they do to some extent overlap the mores of the central culture, thus placing that major culture in a central position (Group for the Advancement of Psychiatry, 1968; Offer, 1969).

To aid the reader, normal expectations will be presented in the following format:

Emotional Development--This section will display the literature from a set of modal behaviours and accompanying variations for each of these aspects of the major topic:

1. Emotional Maturity
2. Heightened Emotionallity
3. The three basic emotional states:
   Aggressive, Inhibitory (fear, anxiety and worry), Joyous or Happy States of Affectivity
4. Self-concept

Social Development--This section will display the literature for a set of modal behaviours and accompanying variations for the major agencies for socialization of adolescents:

1. The Family
2. The Peers
3. The School

Within each topic, normal expectations will be organized to facilitate a variety of study needs and may be read with varying degrees of detail. The format for each normal expectation is as follows:

Modal Behaviour

Description of the modal behaviour.
List of all pertinent studies.

Variances

Discussion of major variances of age, sex, and socio-economic conditions.

Extended discussion of other important facts and conditions. For example, other cultural variances of importance, contrasting viewpoints, or elaborations on the main theme in the modal behaviour.

2. Emotional Development

The search of the literature on emotional development has been focused on the concepts of emotional maturity; heightened emotionality; the three basic types of emotional states: aggressive, inhibitory (fear, anxiety and worry), and joyous; and the self-concept.

i. Emotional Maturity

Modal Behaviour 1

Emotional maturity is expected to increase with age, but its pace is conditioned by a number of factors inherent in the individual himself and the cultural milieu (Miller, 1974; Hurlock, 1973; Heding and Myers, 1970; Jones, 1965; Crow and Crow, 1965; Dunbar, 1958).

Variances

Age

Heding and Myers (1970) found significant increases in measured emotional maturity between eighth and ninth-graders (13 and 14 years). Conversely, little difference was found in emotional maturity between ninth and tenth-graders.

Sex

Society shows generally more acceptance of overt expression of emotions in boys than in girls (Garai, 1970). Emotional dependence involving need for affection and support is in general more socially acceptable in girls than in boys (McCandless, 1970). There were no sex differences found in emotional maturity of eighth, ninth, and tenth-grade asolescents in the Heding and Myers (1970) study, notwithstanding the fact that they did identify significant differences in physical and social maturity by sex. Female students in those grades tended to be more physically and socially mature than their male contemporaries, but undifferentiated in emotional maturity. In contrast, a composite drawn by Cole and Hall (1970) of two earlier studies, one by Pressey and Pressey (1933) and the other by Stone and Barker (1939) indicate that girls show a greater maturity than boys consistent with other measures of growth. The curve of maturity for girls rises sharply between the ages of 13 and 15. On the other hand, boys increase in maturity at a more even and gradual rate.

Socio-Economic

Social custom in the lower socio-economic class inclines toward more tolerance of overt aggressive acts by boys (Hurlock, 1973).

Other Important Factors and Conditions

Emotional maturity appears to be dependent to a degree on intellectual development. Miller (1974) asserts that intellectual impoverishment, as well as emotional impoverishment, in childhood, may impede the normal attainment of emotional maturity in adolescence. A close relationship between intellectual and emotional maturity is strongly implied by Heding and Myers (1970). The found that the significant increase in emotional maturity between the ages of 13 and 14 and the absence of significant differences between ages 14 and 15 were paralleled by similar findings for measures of intellectual maturity as defined in their study. Much of the responsibility for emotional immaturity in adolescence is ascribed by Willkens(1967) to adults who impose excessive expectations for emotional control early in adolescence. Under these unreasonable demands and pressures, the adolescent's attempts to control the overt expression of emotion can, and often does, build up inner tensions, resulting in dire consequences later in life.

Modal Behaviour 2

> As he matures the adolescent is increasingly aware that emotional maturity is more than the simple control of one's overt display of emotion. To be emotionally mature one develops appropriate internal and external control to the end that social approval is gained without serious physical or psychological impairment of oneself (Hurlock, 1972; Offer, 1969; Jourard, 1958).

Variances

No important studies citing age, sex, or socio-economic variances were found in this search of the literature for this modal behaviour.

Other Important Factors and Conditions

Most noteworthy among the signs of emotional maturity, either explicitly or implicitly stated in the literature on adolescence, are the following: Willkens (1967) perceives maturity in the shift at middle adolescence from ego-centred worry, to worry about social relationships with greater personal effort being shown in the control of one's emotions for a social reason.

According to Crow and Crow (1965), emotional maturity is apparent in the adolescent's recognition of the social value of fear. When the adolescent begins to appreciate that intelligent fear can be a safeguard and a desirable restraining influence that promotes personal welfare rather than detracts from it,he is well along toward full maturity.

Another important characteristic of emotional maturity is shown when the adolescent becomes aware that the suppression of an emotion does not eliminate it. The dammed up emotional energy manifests itself in a number of disquieting ways: 1) moodiness, 2) displacement of the emotional reaction from the iniating stimulus to another person or object not involved in arousing the emotion, 3) daydreaming, 4) sullenness, 5) extreme sensitivity to others (Hurlock, 1973; Josselyn, 1971). Sublimation represents a more acceptable indirect expression of a controlled emotion (Hurlock, 1973; Offer, 1969).

Ego strength has a direct bearing on the wholesomeness of control. Autonomy, security and contact with reality mediate favourably for mature emotional control (Jourard, 1958).

Emotional maturity may be identified in early adolescence when the youngster successfully established a "bipolar" relationship with the parents. He gains sufficient independence from the home to permit the development of important extra-familial relations with peers while at the same time maintaining a security base in the home for relaxed tension reduction where he may integrate experiences of the world external to the home (Kohen-Roz, 1971). Total independence from others is not essential to emotional maturity. Rather, there is a wholesome acceptance of mature interdependency as one realizes that others need him as he needs them (Josselyn, 1971).

One index of emotional maturity suggested by Sweeney and Dickenson (1953) is the ability of an adolescent to realistically appraise people and objects. Inherent in his appraisals are his own personal interrelationships. As he matures, the adolescent will exhibit certain characteristic ways of regarding himself and others. He will, 1) be realistic about his own capabilities, 2) view himself objectively and with a sense of humour, 3) be at ease with others and enjoy their company, 4) not be unduly lonely when by himself,

5) accept criticism objectively and without resentment (Sweeney and Dickenson, 1953).

Results of a study by Rosenbach et al., (1973), suggest that the mature individual's impressions of another are influenced less by the degree of emotional involvement with the other person in contrasting negative and positive situations. For example, winning or losing in a game where they are partners. The actual fact of winning or losing does not affect the quality of interpersonal constructs in the older, more mature individual. Thus, aggression in the mature person is more likely to be directed at the instigator of hostility rather than at a neutral person.

Hurlock (1973) identifies four attributes of the emotionally mature individual. Emotional maturity is evidenced when the individual:

1. is able to control emotions which are socially disapproved;
2. relieves dammed up emotions in a socially acceptable way;
3. learns a balance of control to satisfy his own needs while conforming socially, and
4. becomes adept in assessing the appropriate emotional reaction to a situation before reacting to it.

ii. Heightened Emotionality

Modal Behaviour 3

Adolescents who deviate markedly from the norm in the timing and rate of sexual maturing are those most likely to experience heightened emotionality (Hurlock, 1973; Nemy, 1970; Jersild, 1963; Dunbar, 1958).

Variances

Sex

Evidence from growth studies suggest that early maturing may have different effects on boys and girls (Jersild, 1963; Jones, 1949). For boys it can serve as an advantage in reducing the number of frustrations in expression of masculinity (Mussen and Jones, 1957; Schonfeld, 1950; Jones, 1949). For some slow-maturing boys, feelings of inadequacy may persist into later life even after the physical differences which stimulated the negative feeling about self no longer exist (Schonfeld, 1950).

Woronoff (1962) found that fast-growing girls appeared to have greater self-confidence and better emotional adjustment than slow-growing girls; however, Jones and Jones (1962) in a study of material collected in the late 30's and early 40's, before World War II, concluded that early maturing was a disadvantage for girls.

No direct studies dealing with age and socio-economic variances were found in this search of the literature for this modal behaviour.

Modal Behaviour 4

> Causes of heightened emotionality in adolescence are multiple and will include, in addition to the rapid and marked physical changes accompanying the development of sexual maturity, such other factors as social change, physical health and nutrition (Hurlock, 1973; Offer, 1969; Josselyn,1968; Elkind, 1967; Bronson, 1967; Crow and Crow, 1965).

Variances

Age

The best evidence suggests that heightened emotionality is greatest during the last two years of childhood and the first two years of adolescence (Hurlock, 1973).

No direct studies dealing with sex and socio-economic variances were found in this search of the literature for this modal behaviour. Considering the nature of the modal behaviour, it would appear that research is needed to explore variances in sex and socio-economic conditions.

Other Important Factors and Conditions

Hurlock (1973) lists the following predisposing causes of heightened emotionality:

1. Adjustment to new environments
2. Pressure to live up to social expectations
3. Adjustment to the opposite sex
4. School problems
5. Financial and family restrictions to interaction with peers
6. Lack of appropriate adult guidance especially from parents.

Social factors are identified by many studies as the most prevalent cause of heightened emotionality (Cole and Hall, 1970; Elkind, 1967; Bronson, 1967; Gallagher and Harris, 1964; Dunbar, 1958).

Poor health is significantly related to heightened emotionality (Hurlock, 1973; Crow and Crow, 1965; Peckos, 1957). Frustrating stimuli that might be ignored at other times can be very annoying to the adolescent who is ill.

Modal Behaviour 5

> The style of coping with crises in adolescence is not unlike that for other periods in life. Typically the average adolescent will meet crises in this period in a manner that will increase his emotional stability. Crises serve to stabilize rather than threaten personality development (Conger, 1973; Offer, 1969; Jersild, 1963; Josselyn, 1959).

Variances

No direct studies dealing with age, sex and socio-economic variances were found in this search of the literature for this modal behaviour. Considering the nature of the modal behaviour it would appear that research is needed to explore variances in age, sex and socio-economic conditions.

Other Important Factors and Conditions

An exception to the modal behaviour is found in the view of the Committee on Adolescence, Group for the Advancement of Psychiatry (1968), which identifies recurrent alternation of episodes of disturbed behaviour with periods of relative quiescence as a unique characteristic of adolescence. The episodes are intermittent and length of time will vary with individuals.

Willkens (1967) observed that early adolescence is marked by unstable emotions which may be difficult to detect because youngsters in this age group will hide their feelings through use of mechanisms, such as being noisy to cover their lack of confidence.

With the increasing emphasis on research on normal adolescents (Offer, 1969), serious reservations have been raised about the predictions of inevitable "storm and stress" during adolescence. Typical of the attitude emerging is the following statement from Conger (1973):

> It appears that the stresses that adolescence imposes on the individual, particularly in our culture, do not for the great majority, lead to the high degree of emotional turmoil, violent mood swings and threatened loss of control suggested by clinical theorests. All of these consequences clearly characterize some adolescents, but the evidence suggests that there has been an unwarranted tendency on the part of clinicians to generalize too readily to the average adolescent findings obtained from a limited segment of the adolescent population (particularly middle to upper-middle class patients and sensitive, alienated young writers).

Although he recognized some influence of cultural factors, Hall (1904), theorized that heightened emotionality was universal in adolescents and characterized the period as fraught with "storm and stress", the inevitable result of the physical changes occurring in the body during sexual maturing. This tended to support the traditional beliefs that adolescence would be marked by emotional disturbances and upheaval (Hurlock, 1973).

Some modern-day theorists may yet see adolescence as a period of extremes in emotional behaviour, bordering on the pathological, but they rarely agree with Hall's restriction of source to biological origins (Blos, 1967; Josselyn, 1959).

iii. Aggressive States

Modal Behaviour 6

> Anger outbursts are common during early adolescence but in general reduce with age and become more controllable (Biehler, 1974; Offer, 1969; Group for the Advancement of Psychiatry, 1968; Gesell, 1956).

Variances

Age

Definite efforts are made to avoid showing anger at 15 and anger responses are less frequent at 16 and generally are not overt. The adolescent will walk away or avoid an anger-provoking person (Gesell, 1956).

In the study by Offer (1969) the greatest amount of turmoil and aggressive behaviour, particularly that expressed towards parents, occurred in early adolescence, ages 12 to 14. Bickering was the most characteristic form of disturbances, but the intensity of the emotions were not considered by the adolescents themselves to be very deep.

The normal adolescent appeared to have the inner ego resources sufficient to handle aggressive manifestations.

It is not clear in the literature whether anger becomes increasingly controllable in consistent steps through ages 12 to 16 or if it is in erratic stages. Some authors hold that aggressive behaviour tends to be cyclical with recurrent periods of negativism (Committee on Adolescence, Group for the Advancement of Psychiatry, 1968; Gesell, 1956). This is illustrated in excerpts from Gesell's growth gradients for anger in which the most typical responses at each age are as follows:

12 years	physical violence and verbal retort
13 years	sulking, some crying, scowling and frowning
14 years	verbal responses prevail. Some may be unusually violent.
15 years	leaving the room or responding verbally in a sarcastic or negative way.

Sex

In a survey by Remmers and Radler (1957) a substantial number of adolescents reported that they had trouble keeping their temper. This feeling was much more prevalent among girls.

Sex role in Western culture implies an inhibition of aggressiveness on the part of females and implies initiation and instrumentality on the part of males (Holzman, 1974).

Studies of the sexual differentiation and basic neurophysiological differences in both humans and other animals, particularly primates, suggests that females tend to be more passive and less physically aggressive than males. Numerous scientific studies have indicated that testosterone has a direct relationship to the level of aggressive behaviour. Testosterone increases in adolescence almost ten-fold in boys, while it nearly doubles in girls. Thus this physical difference alone suggests greater externalized physical aggressiveness in males (Conger, 1973).

Socio-Economic

Lower-class boys and girls appear to be more openly aggressive than middle-class children (McCandless, 1970; Lesser, 1959).

Likewise, Epstein (1963) reports that lower-class 13-year-old adolescents had more memories containing references to angry feelings and aggressive behaviour, while middle-class adolescents had significantly more memories involving euphoric affect in sibling and parental relationships.

Other Important Factors and Conditions

Anger is more likely to occur when the adolescent is hungry, tired or ill (Jersild, 1963; Young, 1937; Stratton, 1939; Gates, 1926).

Modal Behaviour 7

> The characteristic response to anger in early adolescence is to leave the scene. When angered, the adolescent will characteristically pace the room, exhibit general restlessness, may go out for a walk or indulge in strenuous exercise. Infantile behaviour such as stamping of feet may occur occasionally (Cold and Hall, 1970; Crow and Crow, 1965; Gesell, 1956).

Variances

Age

Physical violence (a sort of extension of childhood ways) and verbal retort by adolescents are more frequently indulged in at age 12 (Gesell, 1956).

Sex

An exception to the modal behaviour was noted in a study of creative high school girls (Halpin, et al., 1973). The authors found that creative girls tended to openly express anger with close friends. Some, incidentally, would follow such expressions with efforts to get even.

Considering the nature of the modal behaviour, it would appear that research is needed to explore variances in socio-economic.

Modal Behaviour 8

The most frequent cause of anger for adolescents is found in social relationships (Halpin, et al., 1973; Greenfeld and Finkelstein, 1970; Crow and Crow, 1965; Jersild, 1963; Hicks and Hayes, 1938).

Variances

Sex

Recalling their adolescent period in high school a group of college males reported that anger both by and towards parents was an often expressed emotion in their home life (Halpin et al., 1973).

No direct studies dealing with age and socio-economic variances were found in this search of the literature for this modal behaviour.

Other Important Factors and Conditions

In order of frequency, anger is provoked in adolescents by 1) people being unfair, 2) siblings taking their property or infringing on private area, 3) being teased, 4) being talked about, 5) parent discipline, 6) opposite sex (Greenfeld and Finkelstein, 1970).

Anger is intensified when the adolescent perceives the provocations of others as intentional (Jersild, 1963; Kaplan and Goodrich, 1957). School, as a source of anger, occurs more frequently in adolescence than in childhood. There is a substantial increase throughout the adolescent years in citing persons in the school setting as being disliked or resented. Also cited as sources of annoyance were prescribed rules and duties (Jersild and Tasch, 1949).

In an early study of junior high school students, Hicks and Hayes (1938) found anger was provoked by these circumstances:

1. being teased
2. unfair treatment by others
3. things not going right
4. sarcasm and bossiness.

Fear and anger are closely interrelated. Both are aroused by conditions that threaten the adolescent's welfare--his physical safety, comfort, plans and desires. Often he becomes angry at himself for being afraid (Crow and Crow, 1965; Jersild, 1963).

Modal Behaviour 9

In early adolescence, particularly ages 12 and 13, the verbal retort supplants physical violence as a common expression of anger (Cole and Hall, 1970; Gesell, 1956).

Variances

Age

Deflected response, or taking out anger on another, also begins to appear at about age 13 (Gesell, 1956).

Sex

Offer (1969) reports that boys cope with anger much as they do anxiety. They readily admit the presence of the emotion and in cases where another person is the cause, resort to sublimating activity rather than direct attack upon the source or erection of elaborate defence mechanisms. Physical activity such as sports are considered a good outlet for pent-up hostility. Bandura and Walters (1959) observed that physical violence is rarely used by non-delinquent adolescent boys.

Socio-Economic

There is considerable evidence that physical aggression is used more often than verbal means to control the youngster's behaviour in low income homes, thus producing a higher tolerance for aggression in their daily lives (National Advisory Commission on Civil Disorders, 1969; Chilman, 1965; Clark, 1965; Moles, 1965; Sears, 1961).

Modal Behavior 10

> The early adolescent's perception and interpretation of violent aggressive acts is related to differences in personal life patterns (Greenberg and Gordon, 1971).

Variances

Socio-Economic

In a study of fourteen-year-olds, Greenberg and Gordon (1971) did not find a significant difference between lower income and higher income groups in their perception of violence. This is in contrast to previous studies which did note a tendency for low income groups to see less violence in productions on T.V. Disadvantaged fourteen-year-olds perceived greater reality in television violence and found such episodes more acceptable and, incidentally, more humorous than advantaged 14-year-olds.

No direct studies dealing with age and sex variances were found in this search of the literature for this modal behaviour.

iv. *Inhibitory States - Fears*

Modal Behaviour 11

The type of fear will vary according to age, sex, and socio-economic conditions. Individual differences within categories will occur as well, depending on what is important in the unique life-style of the individual (Hurlock, 1973; Greenfeld and Finkelstein, 1970; Crow and Crow, 1965; Jersild, 1963; Gesell, 1956).

Variances

Age

In a study of self-reported fears, ages 13 to 85, Spiegler and Liebert (1970) found no significant age differences in the occurrence of unrealistic fears. Their data suggest that new fears and intensity of already existing fears may occur in periods of increased stress accompanied by greater responsibility and productivity. Consequently, it is not uncommon for there to be an increase in the number of realistic fears at the outset of adolescence which will taper off during early adulthood.

In general, a decline in the number of fears between ages 12 and 16 has been observed (Spiegler and Liebert, 1970; Gesell, 1956).

Following his cyclical theory of development, Gesell (1956) found the following fears characteristic of each age:

12 years in general, a fearful age. Fear of the dark mentioned most.

13 years experiencing a decline in fearfulness. Half as many fears as at 12. Now includes crowds and high places as sources of fear.

14 years noticeably fewer fears. Reports fears of animals (especially snakes), the dark, and high places--all about equally.

15 years	slight increase in number of fears experienced over age 14.
16 years	relatively few fears reported. Girls still report fear of dark--especially dark streets. New social situations are mentioned.

The Angelino, Dollins and Mech (1956) study revealed the following age differences in fears:

> Fear of animals shows a rapid decrease after nine, hitting a low at about 12 years.
>
> Fear of school peaked between ages 11 and 12 for girls and around age 13 for boys.

Sex

Boys exhibit fewer fears than girls (Hurlock, 1973; Croake and Knox, 1971; Greenfeld and Finkelstein, 1970; Spiegler and Liebert, 1970; Croake, 1967; Gesell, 1956).

Girls characteristically place a higher value on personal safety and show more fear of animals and strangers than boys (Hurlock, 1973). They show a fear of being alone in the dark to a more advanced age--age 16--and express more fear of parents than boys (Greenfeld and Finkelstein, 1970).

In the Angelino, Dollins and Mech (1956) study, girls expressed more fears than boys about social relations and natural phenomena.

Socio-Economic

In a comparison of fears held by different socio-economic groups, characteristically, lower socio-economic adolescents show a greater number of fears (Croake, 1967) and have more fear of parental threat (Hurlock, 1973).

Qualitative differences in the fears of low socio-economic and high socio-economic pupils were reported by Angelino, Dollins and Mech (1956) as follows:

> Low socio-economic boys expressed more fear of teachers; higher socio-economic boys of susceptibility to stage fright.
>
> Higher socio-economic girls had more fears of school than lower socio-economic girls.

Other Important Factors and Conditions

Fear is not inherited. For the most part, specific fears are learned by conditioning, involuntarily. Much fear stems from observation as well as experience (Willkens, 1968).

Unwholesome fears may be aroused in adolescents by unthinking adults. Parents and other adults who criticize fear reactions of adolescents often force them to become apprehensive about fear, considering it a wrong rather than a normal human reaction. Consequently, it often takes more courage for the adolescent to show fear than to conceal it (Willkens, 1968).

The overriding effect of fear on other aspects of life are shown in a study of 228 male high school students grades 9 to 12, perceptions of occupational prestige and occupation aspirations conducted by Tseng and Carter (1970). The researchers were able to demonstrate that subjects motivated to avoid failure were less accurate in their perceptions of occupational prestige and had lower occupational aspirations than subjects who were success oriented in their motives.

In a study of 1,100 pupils ages 9 to 18, drawn from two different socio-economic levels, Angelino, Dollins and Mech (1956) made an interesting comparison of fears and worries. Using an introspective-projective method to elicit from pupils what they thought were the fears of their peer group, the authors reported that there was little difference in the number of fears experienced by low socio-economic and high socio-economic pupils. Qualitative differences, however, were noted (See discussion under Socio-Economic variance above).

Modal Behaviour 12

> The dominant fears of adolescents are related to social situations and represent a significant change from childhood fears (Hurlock, 1973; Croake and Knox, 1971; Cole and Hall, 1970; Greenfeld and Finkelstein, 1970; Croake, 1967; Gesell, 1956). Moreover, adolescents' fears tend to concentrate on concerns about school (Greenfeld and Finkelstein, 1970; Cole and Hall, 1970; Croake, 1967; Angelino, Dollins and Mech, 1956; Angelino and Shedd, 1953).

Variances

Age

In a study by Angelino and Shedd (1953) on over 500 pupils in public school, ages 10 to 18, it was observed that 13 to 14-year-olds were concerned primarily with school-related fears. There was a noticeable shift at 15 to personal conduct fears and to political and economic fears at 16. No direct studies dealing with sex and socio-economic variances were found in this search of the literature for this modal behaviour.

Other Important Factors and Conditions

An exception to school as the major concern is noted in the studies by Croake (1967) and Croake and Knox (1971) who found that political fears, such as "communists taking over" and "war", ascended to a commanding position. Intensity of such fears, however, was diminished in the most recent study. These results are clouded with speculation because of admitted methodological weakness by the researchers (Croake, 1967). It is worth nothing that rank of school as a major fear in these studies was either third or fourth for boys and upper and lower socio-economic groups. Girls ranked it sixth in the Croake and Knox study (1971). Gesell (1956) reports a higher incidence of fear of animals than more recent studies.

Recent studies(*) have provided the following order of frequency for fears.

Croake and Knox, 1971	Political, personal relations, animals
Cole and Hall, 1970	School, accidents, disease
Greenfeld and Finkelstein, 1970	School, war (political), snakes
Croake, 1967	Political, safety, home

A sample of junior high school students from the same school used by Hicks and Hayes (1933) served as a basic reference point for the Greenfeld and Finkelstein study. This study showed a lower per cent of fear in general and a higher placing of school-related fear. Political and economic fears became predominant at age 16.

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* These data do not necessarily apply to Canadian situations. A Canadian study on the topic is still to be done.

Winkles (1949) reported fewer fears of domestic animals and more fears of physical harm observed in teens than in preadolescents.

Fears from childhood can persist into adolescence and even beyond. Jersild and Homes (1935) found that nearly half of childhood fears of animals carried over to adolescence; one-third of childhood fears of accidents and injuries continued into adolescence; and two-fifths of fears related to personal failure or inadequacy aroused in childhood persisted into adolescence.

v. *Inhibitory States - Anxiety and Worry*

Modal Behaviour 13

A main source of anxiety and worry for adolescents at all ages, 12 to 16, is the school (Greenfeld and Finkelstein, 1970; Offer, 1969; Adams, 1968).

Variances

Age

Worry and anxiety are implicit in the adolescent's identification of his most common problems, and school is a persistently dominant personal problem as identified by all ages, 12 to 16 (Adams, 1968; Abel and Gingles, 1965; Kaczkowski, 1962). It peaks as a problem at 14 for boys and 13 for girls (Adams, 1968).

Sex

Girls show more concern about school marks than boys (Greenfeld and Finkelstein, 1970). Boys were found to express concern about teachers not trusting them as individuals (Offer, 1969).

In a survey of cross-cultural studies, Remmers (1962) concluded that the self-perceived problems of adolescents are ranked with a high degree of similarity. Past high school problems and school-related problems tended to be of major concern to all. Although North American, German, and Indian adolescents expressed major concern about their ability to study, the intensity of such worry was by far greater for Indian youngsters. Concern about health was minimal for all teen-agers regardless of culture. Worry about ability and vocational goals occurs earlier in boys than in girls (Hurlock, 1973). Girls focus earlier on personal appearance and social acceptance.

Offer (1969) observed that adolescent boys showed anxiety expressly about performing before others, their abilities, evaluations made of them by others, and being a part of a group. Clearly, their anxieties centred on social activities, particularly on those that were likely to occur in the school setting.

Interestingly, sex did not appear as an important differentiating factor in the Remmers (1962) survey wherein boys and girls saw study as their most serious problem and being a good sport a problem of minor concern. Both identified wanting to make friends as a major concern; however, girls had more intensity of feeling about it.

No direct studies dealing with socio-economic variances were found in this search of the literature for this modal behaviour.

Other Important Factors and Conditions

In a study of high school students by Mooney (1942), school as a problem ranked third after the categories: future vocational, educational, and finances, and living conditions and employment.

Modal Behaviour 14

> Anxiety is more likely to occur in an adolescent if the individual feels that he is unable to meet the cultural expectations for him (Hurlock, 1973; Offer, 1969).

Variances

No direct studies dealing with age variances were found in this search of literature for this modal behaviour. Considering the nature of the modal behaviour, it would appear that research is needed on age variances.

Sex

Investigations of teen-age worries by Crow and Crow (1965) revealed some important sex differences. Both sexes tend to worry about similar things with some quantitative differences. Males worry about not working hard enough, growing old, and living in shabby homes; females worry more about inability to succeed in the work to which they aspire.

Socio-Economic

The amount of worry is about the same in different social classes but differs in specific detail. For example, school worries for middle-class youngsters centre on concerns about being admitted to the college of their choice, whereas lower socio-economic youngsters are concerned about reciting in class if called on and a perceived hostility toward them from teachers (Hurlock, 1973).

Other Important Factors and Conditions

Adolescent anxieties frequently arise from approach-avoidance conditions. Conflict stems from incompatible desires or impulses. Feelings of fear and anger may be in conflict without the individual being aware of it. Self-determination, interpersonal relations, competitive versus cooperative urges, and repressed guilt are some of the main sources of anxiety-producing stress (Jersild, 1963).

Worry is characteristic of the adolescent years, but if it is to be controlled, the individual must take positive action and locate sources of concern. Competent adult assistance may be necessary if the worry is not to persist over long periods of time (Crow and Crow, 1965).

When the typical adolescent is confronted with troubling emotional problems and conflicts, he is more likely to retreat from introspectiveness of any sort (Conger, 1973).

Teen-age problems or worries are well documented in the comprehensive survey by the Purdue Opinion Poll. Remmers and Radler (1957) in The American Teenager reported the following most common problems of teen-agers in order of intensity for grades nine through twelve:

Do things I later regret
Worry about little things
Can't help daydreaming

Girls expressed greater concern about these personal problems than did boys. One interesting age difference was identified. Where "worry about little things" was lowest in intensity at the 9th-grade level, regret about things done was highest and did not taper off appreciably until the senior year.

Modal Behaviour 15

> The shock of puberty is a source of increased anxiety at the beginning of adolescence. It may be anticipated that the adolescent will spend much time in deep thought, usually secretive, about the changes both physical and emotional that are taking place at the moment. Normally, outbursts of anxiety will begin to subside in about two or three years as the adolescent becomes accustomed to the new aspects of self (Nixon, 1966; Group for the Advancement of Psychiatry, 1968; Iwawaki *et al.*, 1967).

Variances

There were no studies found in this search of literature that dealt explicitly with variances of age, sex, or socio-economic conditions on this modal behaviour.

Other Important Factors and Conditions

Evidence from the use of projective tests reveals widespread anxiety among adolescents (Jersild, 1963; Frank *et al.*, 1953). In a list of problems compiled from a number of studies in the 1940's and 1950's, Cole (1959) identified the following most persistent and serious personal problems in order of intensity.

1. Suffering from nausea
2. Sexual development
3. Being under or over weight

4. Worrying over examinations

5. Worrying over atomic warfares

Modal Behaviour 16

> Marked changes in cognitive ability contribute to an increased potential for anxiety and worry in early adolescence. When the adolescent is capable of carrying out formal operations in his thinking, he is no longer confined to perceived realities and can formulate hypotheses which may serve to stimulate a vivid imagination (Conger, 1963). Much worry and anxiety in adolescence is found in part in a new found ability to exaggerate, to "borrow trouble" as it were. It is not surprising, therefore, to see a disruption of psychological equilibrium occur at the onset of puberty in normal adolescence (Conger, 1973; Hurlock, 1973; Crow and Crow, 1965).

Variances

There were no studies found in this search of literature which dealt directly with variances of age, sex, or socio-economic conditions for this modal behaviour.

Other Important Factors and Conditions

Signs of anxiety in adolescence are identified by Jersild (1963) as follows:

1. Individual response out of proportion to a given situation: greatly upset by little things, excessive anger at trivial frustrations
2. Underreacts - shows no anger when justified, apathetic when joy reasonably expected response
3. Compulsive drives
4. Acts out of character
5. Excessive rigidity, self-righteousness, dogmatic
6. Sets impossible standards for himself

7. Failing in school.

vi. Joyous and Happiness States or Affectivity

Modal Behaviour 17

> On the whole, most adolescents in the age range 12 to 16 are happy and experience many joys (Offer, 1969; Group for Advancement of Psychiatry, 1968; Coleman, 1961; Gesell, 1956).

Variances

Age

Adolescents report varying degrees of happiness and reasons for being happy vary according to age (Gesell, 1956).

At twelve most report being happy.

At age thirteen there is an increasing number of adolescents reporting that they are not very happy--they tend to be only moderately happy or calm. Happiness is reported in terms of trips or visits, and success in school.

At age fourteen there is an increase again of reported happiness. Sources of happiness are success in sports, clothes, boys asking girls out, and going to camp.

At fifteen, again the majority consider themselves happy. The sources of happiness are found to a large extent in school, school politics and play, dances, and looking forward with anticipation to future things.

The majority of sixteen-year-olds describe themselves as happy with the sources of happiness being diverse and unspecified.

Middle and late teens find happiness in self-improvement and other's good fortune more than do younger children (Jersild, 1963).

General good health plays an important part in the happiness of the adolescent, but it is not as important as it is for the younger child (Hurlock, 1973).

Sex

In their wishes for the future, boys placed happiness above athletic achievement, altruism or idealism but subordinated it to such things as academic achievement, wealth and interpersonal relations (Offer, 1969). The following sex differences were noted in responses to questions in the Coleman study. Boys favour leisure time activities involving organized outdoor sports, hobbies and watching television, in that order. Girls on the other hand indicate preferences for reading, being with the group, riding around town, and listening to records or the radio, in that order (Coleman, 1961). Girls find more happiness in companionship and other social relationships than do boys, while boys find more happiness in sports and amusement and recreational places than girls (Jersild, 1963).

No direct studies dealing with socio-economic variances were found in this search of the literature for this modal behaviour.

Other Important Factors and Conditions

Jersild (1963) sees a variety of things that can cause an adolescent to be happy. Among them are: a feeling of satisfaction with home and school, the peer group, material objects (e.g., money, gifts), and sports and games. The causes of happiness depend more on a feeling within the adolescent. Hurlock (1973) lists good adjustment to a situation, feelings of superiority, release of pent-up emotional energies, and perception of comic elements in a situation as the major causes of happiness.

Modal Behaviour 18

> Affection for others becomes more intense during adolescence (Hurlock, 1973). This affection is usually focused on peers, adults outside of the home and occasionally family pets (Hurlock, 1973; Crow, 1965). In some instances, adolescent affection may even centre on real or fictitious heroes (Hurlock, 1973). However, he will refrain from open displays of affection (e.g., kissing) for fear of ridicule, social disapproval, or rejection. Rather, he will express his affection by trying to be with the person, making the person happy and listening intently to everything the person says or does (Hurlock, 1973; Crow, 1965).

Variances

Age

During early adolescence, affection is beginning to develop in relationships with the opposite sex. Adolescents at this age often develop crushes on older youths or adults (Willkens, 1967).

During middle adolescence, affection may be found among small groups and close cliques. Generally, there are fewer love objects. "Going steady" increases and adolescents may even experience a case of "puppy love" (Willkens, 1967).

In late adolescence, the number of people for whom the adolescent displays affection is smaller still. In fact, he may have already selected one special person for whom he shows affection. (Willkens, 1967).

Sex

Girls are usually more ready than boys to start developing affection in relation to the opposite sex during early adolescence. However Willkens(1967) cites a changing trend due to social practices which seem to be hurrying boys' readiness and causing dating to be started at an earlier age. Willkens also observed that girls often develop more crushes than boys.

Socio-Economic

In a study by Goldfarb (1943) adolescents raised in institutions were found to be incapable of freely forming emotional ties and of demonstrating freedom in their intellectual capabilities.

Other Important Factors and Conditions

In most studies cited, affection and love were dealt with basically on the same level. According to Hurlock (1973) the difference between love and affection is that love is a stronger emotion, usually directed towards the opposite sex, and containing elements of sexual desire.

According to Crow (1965) teen-agers see love as a mutual affection that grows until you can't see any other person. To love and to be loved is highly important to the adolescent. Even though this love could probably be best described as "puppy love", it is most dramatic and serious for the adolescent (Willkens, 1967; Jersild, 1963). Some authors interpret an adolescents' first sharing of love--loving someone of the opposite sex and being loved in return--as a revelation (Jersild, 1963; Wenkart, 1949).

Erikson (1963) describes adolescent love as a means of defining identity. The adolescent, by projecting his diffusion ego-image on someone else, sees the ego-image reflected and clarified.

It is obvious from this search of the literature that information on joy and happiness among adolescents is seriously lacking. Of the books published in the 70's that were surveyed in this search, Hurlock's (1973) was the only book to give any particular attention to these emotions. Perhaps the preoccupation with the disturbed and the atypical adolescent has again distorted our view of adolescence. We know more about their anger and inhibitory states than their joys and pleasures.

vii. Self-Concept

Modal Behaviour 19

> A major task of adolescence is the reevaluation and redefinition of the self-concept. The advent of puberty and the shift in society's attitude toward the individual force major changes in the concept of self; thus, the adolescent typically begins an assessment of himself from several perspectives, with particular emphasis on the real and the idealized self (Bohan, 1973; Cole and Hall, 1970; Jersild, 1963).

Variances

Sex

Bohan (1973) using the Coopersmith Self-Esteem Inventory (1959, 1967) to assess age and sex differences in self-concept reports a significant drop in self-concept among 10th-grade girls. It is hypothesized that the girls recognition at this time of the female role expectations for her results in a de-evaluation of self, concomitant with the perceived relative inferior status of the female role. This finding is in conflict with earlier studies by Engel (1959), Piers and Harris (1964). It is in accord with a previous study by Katz and Zigler (1967) in which a lower self-concept was found for adolescents than younger children.

Collins (1972) reported significant improvement of self-concept through a self-improvement course for females, ages 13 to 18, who had social-emotional problems. The self-improvement course was an adjunct to case-work therapy.

Variances pertaining to age and socio-economic differences were not found in this search of the literature for this modal behaviour.

Other Important Factors and Conditions

Early adolescence is a major first step from the self-centred world of childhood to the mature adult world of thoughtful social interrelationships. Adolescents in this period are still very self-centred. Thus, they are very egocentric, with strongest desires centred on gaining social approval. Often the interest in self is expressed in a desire to display a sense of responsibility. Failure and procrastination are not uncommon, however, and adults should be patient as the ability to accept responsibility will follow the desire if one is not completely devastated by his failures (Willkens, 1967).

The fifth psychosocial stage in Erikson's theoretical formulation of ego development seems very apropos this modal behaviour. In an extension of Freudian theory, Erikson (1963) postulated eight psychosocial stages of man, stressing the concept of critical periods throughout life. Discussion of the stages are available in several sources other than Erikson's own works (Biehler, 1974; Horrocks, 1970; Elkind, 1970).

Erikson's fifth psychosocial crisis, occurring somewhere between ages 12 to 18, involves the conflict between identity and role confusion. The goal of this period is to utilize the adolescents newfound integrative abilities to achieve ego identity (Elkind, 1970). The individual brings to bear all that he has learned about himself in the past and re-groups it into new patterns that give a sense of direction and continuity to his future. The process is particularly important to the preparation for adult sexual and occupational roles (Biehler, 1974). Erikson's emphases for this period are elaborated in detail in his book, Identity: Youth and Crisis (1968).

Modal Behaviour 20

> The self-concept is learned through interaction with the interpersonal and objective environment. It is a complex of many views of oneself. The individual during adolescence becomes especially observant of his intellectual competence, physical attractiveness, physical skills, social attractiveness, sex identification, leadership and moral qualities, and sense of humour as they unfold (McCandless, 1970; Jersild, 1963).

Variances

Age

Characteristically, when asked in the Gesell (1956) study to locate the self, adolescents showed the following age differences in response:

12 years	response was comprehensively "all of me"
13 years	emphasized thinking
14 years	emphasized emotion
15 years	associated it more with the brain
16 years	usually referred to the self as an inseparable whole.

Sex

Testing the null hypothesis of no relationship between self-evaluation of personal appearance and total self-concept, Musa and Roach (1973) found a statistically significant relationship for girls. There was in general a wide-spread dissatisfaction among girls with their appearance and a desire to change appearance.

No direct studies were available in this search of literature which treat socio-economic variances for this modal behaviour.

Other Important Factors and Conditions

Revlin (1959) studied the attitude toward self of high school students nominated as creative by teachers. The students so nominated when compared with a group identified as non-creative by teachers rated themselves as having more confidence in relationships with people. They were also seen as more popular by peers. Two factors that appear to be associated with creativity in this study were:

1. social confidence,
2. a somewhat higher educational attainment of parents.

Modal Behaviour 21

> Self-esteem plays a major role in the development of a positive self-concept in adolescence. It is a product of the value the individual places on the complex of views he has of himself--whether approving or disapproving; accepting or rejecting (McCandless, 1970).

Variances

Age

Measures of self-esteem and esteem for parents were made of 159 high school students by Bruch, Kunce, and Eggsman (1972). The study was undertaken to ascertain age and socio-economic differences. Results were as follows:

1. disadvantaged subjects scored higher on self-esteem,
2. older students had lower father-esteem scores,
3. culture and age were not related to esteem for mother,
4. the greatest discrepancies between self and parental esteem scores occurred among the disadvantaged.

The authors find that result No. 2, above, agrees with a previous study by Long, Ziller, and Henderson (1968). Trowbridge (1972) concluded that self-concept seems to decrease with age and to vary insignificantly for sex.

Sex

In a longitudinal study over a six-year period, beginning with the subjects in the sixth-grade, Carlson (1965) found self-esteem independent of sex at both the preadolescent and adolescent level. These results obtained even though girls showed an increase in social orientation while boys increased in personal orientation, thereby reflecting different processes in personality development of boys and girls during adolescence.

Soares and Soares (1969) were unable to find significant sex difference in self-esteem in a study of disadvantaged and advantaged children in grades 4 through 8.

Socio-Economic

Most interestingly, Soares and Soares (1969) report differences in self-esteem by socio-economic group, with higher self-perceptions recorded for the disadvantaged. Both groups showed positive self-perceptions according to the authors. The lower self-esteem of the advantaged group is attributed by the authors to greater pressures and expectations by parents and adults. One may conclude that the challenge in education of the disadvantaged is to raise levels of aspiration without lowering self-perceptions as the child moves into middle adolescence. The disadvantaged individual's educational experiences during 12 to 16 are crucial.

There are conflicting findings in studies of self-concept and socio-economic status. Ausubel and Ausubel (1963), Erikson (1963), and Witty (1967) postulated that children of low socio-economic status reflect the negative image society holds of them. Support for this view is found in the studies by Deutsch (1960), Long and Henderson

(1968), and Wylie (1963). Others found no significant differences in self-concept of children of different socio-economic status (Coleman, 1966; McDaniel, 1967; Scott, 1969). Some investigations report a surprising finding that low socio-economic children may even have a more positive self-concept than middle-class children (Clark and Trowbridge, 1971; Zirkel and Moser, 1971; Green and Rohiver; Soares and Soares, 1969; Trowbridge, 1969, 1970).

In a recent study on differences in self-esteem for different socio-economic levels, Trowbridge (1972) administered the Coopersmith Self-Esteem Inventory to 133 classrooms from a total of 42 elementary schools, rural and urban. Children were included from grades three through eight. Results clearly indicated that the socio-economic factor was highly significant, as also was race and density of population. Low socio-economic, black, and rural-small town children recorded higher self-concept scores on the Coopersmith Self-Esteem Inventory than their respective counterparts.

The specific areas on the Coopersmith Self-Esteem Inventory in which low socio-economic youngsters obtained higher self-concept scores is very revealing. Middle socio-economic youngsters were higher on subscales: general self, social self-peers, and surprisingly on school, academic.

A breakdown of items portrays the lower socio-economic child as feeling more sure of himself and believing he can take care of himself. He makes up his mind readily and is assured that what he has to say is worth saying. In general, he indicates that he is happy, sure of himself, and not usually bothered by things.

Likewise, with respect to peers, the low socio-economic youngster feels more comfortable with peers, believes he is likeable, and assumes that he is popular.

Most strikingly, Trowbridge found that the low socio-economic child perceives himself in a more favourable light than do middle-class children on the school subscale. Low socio-economic children revealed a higher level of feeling worthwhile in school and in the eyes of their teachers. These puzzling results, Trowbridge explains, are probably due to low socio-economic children's lower aspiration level. They also perceived parents, teachers, and peers as expecting less of them. For them, to excel seemed to be equated with stress and tension.

Further, when low socio-economic children perceived school as poor, they did not relate the experience to themselves; whereas, middle socio-economic children "tended to view shortcomings of the school experience as being their fault..."

This reviewer is most intrigued by the contrast of the higher home-parent self-esteem score than school self-esteem score for middle socio-economic children and the low achievement for low socio-economic children. It suggests that much thought need to go in to planning for more effective schools for both groups.

Other Important Factors and Conditions

In a study designed to compare the self-concepts of Canadian grade-eleven adolescents differentiated in terms of ethnic background and geographical location, Dooley (1970) found significant differences in self-concepts as follows:

The Alberta French minority expressed greater assertiveness, effectiveness, and sociability than the Quebec English minority; whereas, the Quebec French majority showed higher score than the Alberta English majority on the affective, assertive, effective and sociable dimensions of expressed self-concept. Only the Alberta French showed no discrepancy between the self and the ideal self-concept. Dooley suggests that achievement motivation, stemming from the combined effects of migration and an environment where cooperation with other ethnic groups is vital, may account for their greater self-actualization displayed in this study.

Modal Behaviour 22

> A new kind of egocentrism begins to unfold in adolescence. It is an egocentrism which is clearly distinguished from the egocentrism of earlier childhood largely in terms of the increased ability to conceptualize thought, both of self and others. As he becomes capable of formal operations and can consider hypothetical possibilities, the early adolescent characteristically believes the others are as preoccupied with his appearance and behaviour as he is (Conger, 1973; Horrocks, 1970; Elkind, 1967; Piaget, 1967).

Variances

Age

As one moves through adolescence he will normally omit the metaphysical belief in the omnipotence of his new found reflective capabilities and replace it with an understanding that the appropriate function of reflection is to confirm reality by predicting and interpreting experience (Horrocks, 1970; Piaget, 1967).

Cognitive performance undergoes significant change somewhere between ages 12 to 15, varying for the most part in terms of cultural differences. The advent of puberty at about the same time is seen as merely a correlated event with no evidence of a causal relationship (Horrocks, 1970; Piaget, 1967).

Yudin (1966) observed a significant difference in the development of formal thought among normal and low intelligence groups. Appreciable gains in normals occurred between ages 12 to 14; in low intelligence youngsters, 14 to 16. Although Wolfe (1963) found that youngsters classified as abstract thinkers did better than those classified as concrete thinkers in formal thinking between ages 11 to 13, he concluded that few did very well until age 14. Further, he contends that these are major differences between 11 and 13 years of age. Elkind found evidence to support Piaget's formulation of adolescent thought as being more logically elaborate than the thought of children.

Formal operations become well established by the age of 15 or 16, and the egocentrism of adolescence diminishes as the youngster becomes more acutely aware of the differences between his own concerns and the interests and concerns of others. Adolescent egocentrism subsides also to the degree that the adolescent can integrate the feelings of others with his own emotions (Elkind, 1967).

No direct studies dealing with sex and socio-economic variances were found in this search of literature for this modal behaviour.

Considering the nature of the modal behaviour, it would appear that research is needed on these variances.

Other Important Factors and Conditions

The crux of adolescent egocentrism is that, even though he can conceptualize thought in a uniquely different manner from the childhood reliance on concrete operations, the adolescent is unable to differentiate between objects towards which the thoughts of others are directed and those upon which he focuses his concern. Thus, his preoccupation with his rapidly changing self forces an assumption on the adolescent's part that all others see him as he sees himself. He is terribly self-conscious and he is self-critical, others are also assumed to be critical of him (Conger, 1973). Their feelings are a mirror image of his own feelings about himself.

Conger (1973) has identified other characteristics of adolescence which are a by-product of the level of cognitive development. They are as follows: the frequent use of irony--the elaborate "put-on" or "put-down"; the delight in the use of double entendre. Defence mechanisms undergo qualitative change from childhood to adolescence. Intellectualization is used by adolescents and represents a higher form of cognitive ability than the simple denials used by younger children. Feelings of depression occurring in adolescence may also relate to the development of formal operations as a facilitating factor.

3. Social Development

The social development of the adolescent depends in great measure on opportunities afforded him to interact with his environment. It is by so doing that he learns. Since learning is the major psychological process for social change in the individual, this review of the literature has concentrated on learning as it functions through the principal agencies for socialization in adolescence: the family, the peers, and the school. Each modal behaviour in this section deals with an important aspect of interaction between the adolescent and social environment formed by these socializing agencies.

i. Family

Structure

North American families are typed in the literature according to background features such as ethnicity, race, social-economic status, religion, and other factors (Sebald, 1968).

Within the last century there has been a major change in the internal structure of the family. Before 1900, most families were extended families, including not only the immediate members but the additional related and non-related members. With the movement of the family to the urban areas, the formation of nuclear families become became more evident. According to Sebald (1968) this has had an effect on adolescents by limiting adult models. The adolescent no longer has a direct contact or visibility of adult work as he did in the extended family and where before he formed friends with members of his extended family, he now seeks friends outside the kinship group (Sebald, 1968).

Sebald (1968) and Lugo and Hershey (1974) found there was an increase in divorce, separations, and desertions which have produced a disintegration of the nuclear families. With this disintegration, Miller (1974) sees an effect on adolescents which may cause a tendency toward delinquency.

Anderson (1968) in a study on parental deprivation found a significantly higher than average rate of delinquency among boys living with their mothers following the loss of a father through death, parental separation, or divorce. Hetherington (1972) in a study on the effects of father absence on adolescent girls found that father absence effects show girls are more likely to be more dependent as adults and as adolescents they show anxiety about relating to males. Daughters of widows tend to be shy and withdrawn and tend to start to date late in contrast to daughters of divorcees, who tend to seek out male peers and are more likely to begin to date earlier and have sexual intercourse at an earlier age.

McCandless and Evans (1973) in a study of sex identification and absent fathers found that the presence of an older brother will off-set the father-absence effects on aggression and dependency in both boys and girls.

Hurlock (1973) observes a social mobility in which North American familes move up and down the social scale of socio-economic classes. Adolescents learn that ways in which they can move in social mobility is through education or marriage (Cole and Hall, 1970).

Function

Sebald (1968) has listed three major ways in which the functions of the family have changed: a number of traditional family functions are being transferred to other institutions, the modern family is becoming a specialized agency and people are turning to the family to derive a sense of belonging and psychological security.

The family is seen by Weber (1974) as being a functional social system with boundaries, members, relationships, rules and roles. Weber feels that each family needs to achieve a level of comfortable functioning and members of a family help to maintain this balance overtly and covertly.

Jersild (1963) sees the adolescent's relationship to parents in three steps. As a young adolescent he continues to need his parents, to be dependent on them and to be influenced by them. The second step is when the adolescent must outgrow his childhood dependency on his parents, must renounce major allegiance to his parents and shift his allegiance to prospective mates and advance to the third step when he takes his adult role in society.

Modal Behaviour 23

Autonomy becomes a major developmental need during adolescence. Normally the move toward autonomy proceeds with minimal conflict and struggle within the family, but some antagonism is to be expected. Parents, typically are understanding and supportive of the adolescents' needs to become independent and self-sufficient (Miller, 1974; Bruch, 1972; Horrocks, 1970; McCandless, 1970; Gold and Douvan, 1969; Offer, 1969; Long, Ziller and Henderson, 1968; Coopersmith, 1967; Willkens, 1967; Douvan and Adelson, 1966; Blos, 1961; Gallagher and Harris, 1958; Pearson, 1958).

Variances

Age

Although the move toward autonomy begins during early adolescence, Kohen-Raz (1971) and Jersild (1963) feel that the individual continues, as in childhood, to need his parents. For a time he must establish bipolar relations with them, seeking independence from their control while depending on them for tension reduction and interpretation of experience.

An increase in dependency in early adolescence with a decrease in later adolescence was noted by Long, Ziller and Henderson (1968) in a study investigating developmental changes in self-concept during adolescence. It was suggested that the decline in dependency after grade nine might be another example of anticipatory socialization in preparation for independence of early adulthood.

According to Douvan and Adelson (1966), there is a sharp increase in autonomy during adolescence with the largest behavioural change taking place in dating. The adolescents' commitment of leisure time to family relationships prevails for the majority through age 18.

In early adolescence, adolescent antagonism or so-called rebellion should be expected to develop and can best be dealt with as normal behaviour and is best treated with understanding (Group for the Advancement of Psychiatry, 1968; Willkens, 1967).

Miller (1974) in his observations of early adolescence found that it is associated with a wish to be free from dependent feelings on parents.

Sex

In a national sample of adolescents, conducted by Douvan and Adelson (1966) it was found that boys were significantly more likely to be actively engaged in establishing independence from parental control than girls. Adolescent girls were more likely to consider their parents' rules to be fair, right, or lenient; moreover, girls are more likely to progress from a dependent identification of authority without the phase of defiance.

Jerome Kagan and Howard Moss (1962) found in a longitudinal study of development from early childhood to maturity that dependency was a more stable trait in girls than in boys. Girls who were most dependent in childhood were also most dependent as adolescents and as adults. Emotional dependency for girls in our society is found to be fairly acceptable but it is less so for boys (McCandless, et al., 1961). In accord with McCandless' findings, Miller (1974) found early adolescent boys to be particularly intolerant of control by women, especially their mothers. Girls, however, were found to lean on mothers for advice, some even maintain a child-like dependence.

Other Important Factors and Conditions

The emancipation phenomena are unique to North Americans in Western civilization. One facet in promoting early emancipation in North America is the substituting of peers for parent dependency (Meyers, 1946).

Offer (1969) maintains that one of the main functions of adolescent rebellion in normal youth is to serve to initiate or reinforce the process of becoming emancipated from parental authority or dependence. In this same vein, Gallagher (1959), Pearson (1958), and Blos (1961) see rebellion by adolescents as manifestations of thwarted attempts at independence.

In order to acceed to the adolescents' desire for self-control during the process of emancipation, requires a sacrifice on the part of parents in relinquishing authority, developing and maintaining self-control and restraint, and in adjusting to and accepting new values and customs (Meyers, 1946). The adolescent, typically, resents domination and his struggle against dominance depends on whether he feels that the dominance is reasonable and whether he rejects or accepts the parental motives (Horrocks, 1969; Bernard, 1945; Levy, 1943).

Willkens (1967) maintains that hidden beneath the outward manifestation of lack of respect for parents by adolescents when disciplined, the early adolescent harbours a feeling of satisfaction and a sense of security in their concern.

Offer (1969) agreed with Freud's idea that when an adolescent rebels it is often in the form of negation--he does what his parents do not want him to do (Freud, 1925).

Adolescents have a need for aggressive defiance of openly stated norms of society (Miller, 1974). Indulgence up to a point appears to make the adolescent adjustment easier by providing a permissive atmosphere which is conducive to the move toward independence. It gives the adolescent a sense of security. Overprotection or overindulgence, however, appear to cause difficulty in the adolescent's adjustment to the outside world. In such cases, the adolescent never seems to rid himself of the egocentrism of childhood and finds it extremely difficult separating from his parents (Conger, 1973; Horrocks, 1970; McCandless, 1970; Coopersmith, 1967).

In a study in which he examined the relation between autocratic, democratic and permissive parental practices, Glen Elder (1963) hypothesized that autonomy would be most common among children of parents who were more permissive and less autocratic and who frequently explained their reasons for rules of conduct and expectation.

One area in which so-called adolescent rebellion seems to be minimal is in the area of mate selection (Adams, 1968). According to Cole and Hall (1970) parents need to allow freedom of choice as to mate selection. Miller (1974) observed that one way in which adolescents develop autonomy and assert their separate identity is by keeping sexual intimacy a secret from parents.

Modal Behaviour 24

> Although highly differentiated from earlier childhood dependence, there are still throughout adolescence many needs which must be fulfilled through appropriate interaction with the parents and the family if trauma or maladjustment is to be avoided (Miller, 1974; Conger, 1973; Hurlock, 1973; Forslund and and Hull, 1972; Gordon, 1972; Gold and Douvan, 1969; Offer, 1969; Berkowitz and Friedman, 1967; Eisenberg, 1965; Jersild, 1963; Landis, 1954).

Variances

Sex

Kagan and Moss (1962) stressed the importance of gender role modelling. Mussen is cited by Forslund and Hull (1972) as showing evidence in a study that children tend to identify with parents of the same sex. Forslund and Hull (1972) studied 5,672 sixth-grade boys and girls and found that boys identify strongly with masculine role models and that girls tended to identify with boy male and female models more than boys. In this way the adolescent is fulfilling the need for sex-role identification.

Offer's Modal Adolescent Project Study (Offer, 1969) found a great majority of boys reported that the nicest thing about home was the emotional comfort it afforded. Girls, also, retain emotional ties with parents through early and middle adolescence, choosing parents as confidents and accepting parental restrictions (Douvan and Adelson, 1966).

Sex differences in family-oriented versus peer-oriented preferences were noted by Bowerman and Kinch (1959). The greatest shift from family to peer orientation takes place approximately one year earlier for girls than for boys; for girls, between grades six and seven; for boys, between grades seven and eight.

Socio-Economic

In a study in which they tested their hypothesis about the differences in the effects upon adolescents of different socio-economic families, Berkowitz and Friedman (1967) found their hypothesis valid in that adolescents from entrepreneurial families are likely to act in order with the level of help received whereas those adolescents from bureaucratic families follow more in accord with rules and regulations of society.

Hess and Goldblatt (1957) found that adolescents and parents agree in mildly favourable opinions of teen-agers. Work values of children were found to be directly related to the work values of the family in a study of 121 eleventh and twelfth-grade boys by Kinnane and Pable (1962). Teen-agers, studied by Offer (1969), agree with and in general share their parents' values which reflect middle-class standards.

As a group, the affluent bring up children to be achievement-oriented, work hard, control their aggressions, conceal their sexuality and to communicate with parents. These families are more likely to be liberal in child rearing and use less physical discipline and more affection. Joint activity and togetherness are stressed by the affluent family (McCandless and Evans, 1973).

Other Important Factors and Conditions

The majority of the boys studied by Offer (1969) felt they were generally disciplined reasonably and fairly. Observations by Landis (1954) indicated that the democratic administrative pattern of discipline over the authorization form prepares an adolescent better for adult roles.

Socialization is an important aspect of an adolescent's development. Gordon (1972) concurred with Landis (1954) in noting that family contacts are important in the socialization of the adolescent.

Conger (1973) restates Eisenberg's (1965) theory that the manner in which the adolescent develops and accepts the role of an adult depends upon the parents.

In 1950, Remmers and Hacket conducted a national survey which indicated that nine-tenths of the young people polled expected their parents to help them shape their ideas of right and wrong about sex problems.

Because of the adolescent's needs for information regarding sex education, parents have a responsibility for the adolescent's sexual feelings and attitudes and should maintain implicit and explicit communications with the adolescent (Miller, 1974). Parents should be open and free in discussions on sex so they will provide the education in order to form healthy attitudes about sex (Willkens, 1967).

It is of value for the adolescent to have someone to confide with. In a study by Tryon (1939) it was found that the percentage of boys and girls who "talk to mother or father" was consistently greater at all ages, grade 6 through 12, than those who "talked to a friend" when worried about something. There was an increase in percentages of those who relate to friends as the boys and girls advance in age; however, the parents were chosen over peers.

Willkens (1967) describes seven basic needs for young people:

1. the need for self-understanding
2. the need to be understood
3. the need for relationships with others
4. the need to gain independence
5. the need for sex education
6. the need for future planning, and
7. the need for a vital faith.

Modal Behaviour 25

Within the range of normal adolescent development, some problems and conflicts between the adolescent and his family will occur and will vary according to basic personal and cultural factors. In addition to autonomy, friction may develop over home conditions, lack of communications, conflicting values, and control and authority (Hurlock, 1973; Horrocks, 1970; Gold and Douvan, 1969; Offer, 1969; Adams, 1968; Datta, Schaeffer and Davis, 1968; Bronson, 1967; Crow and Crow, 1965; Adams, 1964; Epstein, 1963; Jersild, 1963; Herron, 1962; Kohn, 1959; Bronfenbrenner, 1958).

Variances

Age

Patterns of parental behaviour may vary with the age of the adolescent. Conger (1973) observes that because the adolescent is capable of principled objections , the head-on confrontations that served to strengthen authority in early years undermine authority during adolescence.

Both parents and adolescents reported that most arguments with parents took place during seventh and eighth-grade (Offer, 1969).

Sex

Block (1937) found that 60 per cent of over five hundred junior and senior high school boys and girls checked complaints relating to parents and home. He also noted that girls checked a larger number of complaints than boys.

A study in 1940 by Stott involving several hundred adolescents revealed that girls criticized their parents more than boys. Meissner (1965) in making an assessment of the occurrence of typical parent-child interactions in a population of 1,278 high school boys from nine schools, found that: 1) mothers were perceived by the boys as being more responsive to emotional needs than fathers--a perception that became more dominant through the adolescent years; 2) happiness and satisfaction in the home situation is predominant; however, dissatisfaction and unhappiness increased with age; 3) most approved of their parent's guidance over them; 4) there is a tendency to be more resistant when parental restrictions are imposed in an authoritarian manner.

Girls expressed more home-centred problems than boys according to Adams (1964). Bronson (1967) discovered that girls who receive less support from the maternal model grow up lacking some characteristics associated with successful functioning and will have some developmental problems.

Socio-Economic

Datta, Schaeffer and Davis (1968) in their study on childrens' aptitudes and teachers' ratings found that children tend to be consistent with behaviour attributed to their economic status.

Other Important Factors and Conditions

Basic causes of conflict with parents were listed as nagging and sarcasm, little effort to work out problems rationally and unemotionally, child not trusted, and parent unhappy with own life (Gallagher, 1958). In relating to causes of emotional problems among people, Gallager and Harris (1958) determined that some young people are victims of the emotional problems of their parents.

In Daniel Offer's (1969) study of adolescent boys, the boys reported mothers and fathers worst trait as impulsive and not understanding and the best trait as being emotional-understanding. Eighty per cent of the boys reported that parents use physical punishment.

Bronfenbrenner (1958) summarized that working-class parents are more consistent in employing physical punishment while Kohn's

(1959) study showed that both middle-class and working-class parents do not use physical punishment as first recourse and that middle-class families rely on reasoning, isolation and appeals to guilt as means of discipline. Rejection by parents, according to Herron (1962), elicits aggression and withdrawal responses by the adolescent. Herron sees nagging and excessive criticism as indirect forms of rejection by parents and this will cause adolescents to be insecure as adults.

Waller and Hill (1951) and Kirkpatrick (1955) found that children coming from divorced parents run a greater probability of divorce themselves.

In a study of parent-adolescent conflict, Conner, Johannis and Walter (1954) found that a large number of conflicts centred on dating and choice of boyfriends. Parents need to provide an atmosphere where adolescents can bring friends and should avoid making quick judgments about the adolescent's friends. Parents should also act and look in ways that will encourage appreciation of the adolescent (Willkens, 1967).

Willkens (1967) observed that the adolescent has a craving for self-expression and a desire for a world of his own. Frustrations often arise because the family ask the adolescent to adjust his needs to the needs of the family and the desires of the parents. The adolescent needs to be understood, loved and assured.

A survey by Jersild (1963) of adolescents as to conditions and events which were most helpful or most trying or burdensome to them showed 90 per cent of the tallies applied to home life as the category most often mentioned. Sources of annoyances were found in practically every detail of daily life. Although Jersild in this study in 1963 found problems relating to family predominant, Adams' (1968) investigations found family problems secondary with 10 per cent of total males and 21 per cent of total females studied indicating the family as a personal problem.

ii. Peers

Modal Behaviour 26

> Studies have shown that there is an overlap in the values of parents and peer groups, and because of this the adolescent will often retain the moral and social values of his parents (Conger, 1973; McCandless and Evans, 1973; Mussen, Conger, and Kagan, 1969).

Variances

Age

From investigations of seventh, ninth and twelfth-grade boys and girls, Conger (1973) found that adolescents with high parent-adolescent affect were significantly less likely than those with low affect to see a need to differentiate between the influence of their parents and their best friends.

Sex

In his study on adolescent boys ages 12 to 14 Offer (1969) found that while establishing their independence, adolescent boys would retain much of the parent's value systems.

Socio-Economic

The adolescent's like or dislike of popular music (rock and roll) was found to be dependent on the level of the mother's education (Franklin et al., The Purdue Opinion Panel, Poll 55, 1959). The higher the level of the mothers education, the less likely the adolescent was to like pop music. According to the poll, however, 9 out of 10 teen-agers liked rock and roll music.

Other Important Factors and Conditions

The overlap in values of parents and peer groups is due to common factors in their background (e.g., socio-economic, religious, educational, geographic) (Conger, 197[illegible]; McCandless and Evans, 1973; Mussen, Conger and Kagan, 1969).

Modal Behaviour 27

> A strong need to be a part of a peer group develops early in adolescence. Stimulated largely by a lack of confidence and need for reassurance outside the home, it heightens the need to conform to peer group standards and becomes an important factor in the maintenance of emotional security, development of social attitudes and behaviour, and definition of identify. The influence of the peer group, however, can intensify adverse emotional development and may serve as a powerful influence of development of maladaptive behaviour (Conger, 1972; Hurlock, 1973; Mussen, Conger, and Kagan, 1969; Campbell, 1964; Elder, 1961; Bowerman, 1959; Polansky, 1950; Blos, 1941).

Variances

Age

The need to conform to the peer group is felt greatest by the young adolescent and tends to decline through middle and late adolescence (Conger, 1973; Hurlock, 1973; Landsbaum and Willis, 1971;

Mussen, Conger and Kagan, 1969; Constanzo, 1966).

Sex

In his study of adolescent boys, Offer (1969) found that boys conform to each other in their behaviour, values, dress, recreation, and consumer consumption. However, in other studies it was found that girls were more likely to conform in behaviour to peer groups than boys (McCandless and Evans, 1973; Iscoe, 1963).

Socio-Economic

Iacovetti (1973) found that lower-class boys had more involvement with peers than middle or upper-class boys in the areas of frequency, dependency, and autonomy of interaction.

Other Important Factors and Conditions

There is a major difference of opinion on the concept of a youth subculture. Many researchers and writers on adolescence refer to a youth subculture as a reality.

Sebald (1968) discusses in detail the question of whether there is or is not a teen-age subculture. For the affirmative, he cites six authors: James S. Coleman (1961), Albert K. Cohen (1955), Kingsley Davis (1944), Talcott Parson (1942), R.M. Williams, Jr., (1960), and Arnold W. Green (1968). That there is a subculture seems to be based on three major assumptions: 1) during adolescence the youth is in a state of "storm and stress" due largely to social conditions around him concerning his future, identity, conflicts with his parents, and sexual frustrations; 2) there is a youth subculture;

adolescents create the subculture to ease the social tensions of the adult world and to help in the transition from childhood to adult.

From their early 1950's study of Montreal teen-agers, Elkin and Westley (1955) take the negative view on youth subcultures. They conclude that adolescents are more integrated in adult culture than is generally believed. Their study, however, consisted of interviews with 20 adolescents and their parents and life history material on 20 other adolescents. The generalization they made, therefore, on Canadian youth is considered to be weak. Elkin and Westley concede that their study may not be a completely accurate sampling of the Montreal surburban community from which it was taken. The suburb in which the study took place is classified as upper-middle class.

In extended discussion on the youth subcultures, Sebald (1968) placed it in the middle socio-economic stratum. Characteristically, subculture -oriented youth are known by their independence from adult standards, conformity to the peer-group numerous fads, specific argot, and "participation in 'irresponsible' hedonistic activities". When speaking of the lower socio-economic stratum, subculture often refers to delinquent behaviour. In the upper-class levels, adolescents are more likely to be integrated in family and community.

McCandless and Evans (1973) see the youth culture as pertaining to the adolescent years. The culture obtains its own modes of dress, language, styles of dance, and music. Oddly enough, the image these qualities project may be, and often is , adapted by the adult culture. All of these differences add up to a collective effort by the adolescent group to create an identity for themselves apart from the adult world within this youth culture. Reacting to Kandel's (1970) study on youth subculture, McCandless and Evans (1973) concluded that instead of just one culture, there are many cultures which range in effect from moral and religious beliefs to more or less fads.

McCandless and Evans (1973) make a final reference to the "counter-culture" movement which seems to be a growing phenomenon in North America. Briefly, the movement consists of a rejection of the North American way of life, characterized by intellectual reasoning, self-reliance, personal responsibility, deferred gratification, and advance planning. There is a perceptible move toward a Dionysian life-style with its immediate sensory experience, cultivation of deep interpersonal relationships, and a "back to nature" calling.

Conger (1973) refers to a youth culture made up of an emerging group of older adolescents (17 to 18) who, after graduating from high school, enter either college or the ranks of the unemployed and consequently remain outside the realm of adult status for a longer period of time. This youth culture is perceived by others of society in various ways. Young adolescents often see a highly commercialized version of the culture that presents a false picture of its values, behaviours and attitudes. Some adults who feel threatened by social change see the youth culture as rebellious, promiscuous, and undisciplined. On the other hand, adults who are dissatisfied with society, see the youth culture as the hope of tomorrow. Some of the areas in which adolescents show most conformity are in music, entertainment, language, fashions and dating (Hurlock, 1973; Mussen, Conger and Kagan, 1969; Group for the Advancement of Psychiatry, 1968; Franklin *et al*., *Purdue Opinion Poll No. 55*, 1959).

The *Purdue Opinion Poll No. 55* (1959) indicates that not all adolescents recognize the peer group as being a good influence. They find fault with it in the non-thinking group behaviour, unfairness to non-members, and the promotion of bad habits in individuals.

Other studies have shown that a child who is a product of parental disregard and neglect becomes more peer-oriented (Conger, 1973; McCandless and Evans, 1973; Medinnus and Johnson, 1969; Mussen, Conger and Kagan, 1969).

The peer group does influence the adolescent's use of alcohol and drugs. Brotman (1966) points out that there is a strong pressure for the adolescent to at least experiment with drugs such as L.S.D. and marijuana. In their study, however, Eisenthal and Udin (1972) claim that it is the indirect pressure of the group norm and leader's behaviour which serves as the greatest influence and not the social pressure of the group itself.

Eisenthal and Udin (1972) go on to state that induction into drug usage most often occurs between the ages of 15 and 16, whereas most of the adolescents who use alcohol have been initiated by the age of 14. In the use of alcohol and marijuana, the female group norms were lower than the males but they were higher for the use of "speed", L.S.D., and heroin.

A differentiation from the modal behaviour was found by Hurlock (1973) in slow-maturing adolescents. There is not such a great need to conform for the slow maturer as there is for his more mature age-mate.

Modal Behaviour 28

> The adolescent often becomes part of two basic peer groups formed on the basis of social and ethnic background, common interests, and maturity: the clique and the crowd. While the clique is relatively smaller and offers a more intimate setting, the crowd offers a larger social atmosphere and is primarily responsible for the change from the unisex cliques of early adolescence to the heterosexual cliques of late adolescence (Conger, 1973; Hurlock, 1973; Dunphy, 1963).

Variances

Age

As the adolescent grows, his groups change from unisexual to heterosexual (Conger, 1973; Hurlock, 1973; Wattenberg, 1973).

Sex

Taking into consideration several other studies (Maccoby, 1966; Coleman, 1961; Phelps and Horrocks, 1958; Keedy, 1956), Conger (1973) concludes that girls' cliques tend to be closer, more exclusive, more impregnable to outsiders and more enduring while boys' cliques tend to be more democratic and flexible due to their emphasis on athletic skills and overall sociability (Coleman, 1961).

Socio-Economic

According to Conger (1972), social and economic status is an important determinant for membership in crowds or cliques.

Modal Behaviour 29

> Dating helps the adolescent to develop social and interpersonal skills with the opposite sex as well as to develop a sense of identity and sexual awareness (Conger, 1973). Likewise, interest in the opposite sex increases with maturity and changes from a purely social need for interaction to one of enjoying being with a certain individual (Offer, 1969).

Variances

Age

Conger (1973) points out that dating for the early adolescent causes much anxiety. The adolescent will place emphasis on developing a dating personality rather than interacting with the opposite-sex peer. In later adolescence, however, the emphasis is on developing a meaningful relationship. A consensus of several different studies locates the average age to begin dating at 14 to 15 years for girls and 15 to 16 years for boys (Hurlock, 1973; Conger, 1973; Gold and Douvan, 1969; Douvan and Adelson, 1966; Lowrie, 1951).

Sex

In Offer's (1969) study, 77 per cent of the boys were dating by their junior year; however, most of them dated irregularly and thought dating unimportant. According to Conger (1973) boys are more concerned with shared activities and interests than with emotional and intimate aspects of heterosexual relationships. Biehler (1971) found that girls tend to date older boys who are at their same maturational level.

Socio-Economic

Boys and girls seldom date outside of their own social class, and then only with members of the adjoining class (Conger, 1973).

Other Important Factors and Conditions

In seeking friends of the opposite sex, adolescents will turn to ideals formed from their own cultural group. Adolescent girls see the ideal boy as an athletic hero, while boys see the ideal girl as one who is popular with the boys (Hurlock, 1973).

According to Forslund and Hull (1972) girls perceive their sex-role more in relation to the opposite sex than boys do. Boys identify strongly with both the primary masculine role models of peers, siblings, and fathers, and the secondary role models such as male entertainers and athletes. Girls tend to identify with female and male role models in primary relationships and more with male entertainers and male historical figures in secondary relationships.

Modal Behaviour 30

> Friendships become very intense during adolescence (Conger, 1973; Biehler, 1971). The number of friendships becomes of direct measure of the adolescent's popularity, acceptance, and approval, by his peers (Hurlock, 1973; Coleman, 1961). Adolescents choose friends who share in personal and social characteristics and interests (Conger, 1973; Byrne and Griffith, 1966; Douvan and Adelson, 1966; Brown, 1954).

Variances

Age

The early adolescent wants a friend whose interests, values, and backgrounds are similar to his--primarily, someone with whom to share activities (Hurlock, 1973; Conger, 1973; Douvan and Adelson, 1966; Douvan and Gold, 1966). During middle adolescence the emphasis is on the quality of friendship and the adolescent looks for a friend at this time (Conger, 1973; Douvan and Adelson, 1966; Osterrieth, 1969). As the late adolescent becomes more secure in his own identity and in the development of psychological defences, his dependence on close friends lessens and he becomes more tolerant and appreciative of differences in friends (Conger, 1973; Douvan and Adelson, 1966; Douvan and Gold, 1966). Hurlock (1973) also sees this as a time when the adolescent will seek friends who can help him adjust to members of the opposite sex.

Sex

Girls tend to form more deep, frequent, and dependent friendships while boys tend to choose friends on the basis of common interests and activities shared (Conger, 1973; Douvan and Adelson, 1966).

Socio-Economic

The culture of the community determines the right kind of friends to have. Thus, rich and socially prominent friends are important in a community that places importance on wealth and social prominence (Hurlock, 1973).

Other Important Factors and Conditions

Today's youth place a great emphasis on true and lasting friendships. In two surveys (Harris, 1971; Yankelovich, 1969) nine out of ten adolescents agreed on the importance of more true friendships between people, but only one out of five thought that people could be depended on.

Also, in a study done by Katz in 1968, it was found that between 23 to 34 per cent of the men and 12 to 18 per cent of the women in the study had not had a meaningful friendship with a member of the same sex; and between 37 to 50 per cent men and 23 per cent women had not formed such friendships with a member of the opposite sex by the time they were students in college. Thus, we see a paradox between ideals and actual practice. Conger (1973) offers three possible explanations. First, friendships may be hard to come by due to the stress of our social culture; secondly, adolescents may be putting more demanding standards on friendships; and finally, it is more difficult for adolescents to put their ideals into practice than they anticipated.

iii. School

Structure

Demographic

Impacts upon school population will be felt from the emerging trends in the birthrate. The latest projections indicate that there will be small annual reductions in elementary school enrolments for the next five years. Starting in 1977 and continuing for several years we can expect a tapering off of high school enrolment.

During the late sixties and early seventies, many school boards in Ontario, especially in Eastern Ontario, have set up the intermediate school structure which includes mainly grades 7 and 8. It was felt at the time, and still is, in part, that in the light of recent studies, Adams (1968), for example, there was some psychological support for the grouping of emerging adolescents within this new structure. Although this movement towards a different organizational structure is not one that is generalized in this province at present, it is possible that within a few years, we may find a greater realization on the part of educational authorities of the inadequacy of existing arrangements, K-8 and 9-13 to satisfy some criteria for a program consistent with the physiological and psychological needs of the emerging adolescent.

Functions

In 1965, Mead suggested better shcools for adolescents in which there was more differentiation by special interest, more associations with both younger and older students plus consciously diversified summer experiences.

Theodore Moss (1969) in Middle School saw this new structure as being designed specifically to meet the needs of the preadolescents. In other words to be relevant it should foster:

1. The individual physical well-being of the student during late childhood and early adolescence. Health and physical education activities are designed to accommodate this period of rapid growth and dramatic bodily change.

2. Individual mental health through a continuous program of sex education aimed at understanding the bodily changing during the years 11 to 14.

3. Learning geared to immature and mature students in an atmosphere which challenges but does not pressure the individual.

4. A continuous program of educational guidance. Middle school teachers should be guidance oriented working with specialists as a team.

5. A curriculum that is continuous through 12th-grade.

6. Activities that are related to the interests and needs of middle school students. Recreational activities are a natural outgrowth of classroom activities.

Curtis (1972) states the primary functions of the middle school curriculum as follows:

1. Development of cultural transition from childhood to later adolescence.

2. Establishment of an educational transition from elementary to secondary school education philosophies.

3. Recognition of an appropriate consideration for the extreme variabilities within and among the emerging adolescent group.

Curtis sees the intermediate school as transitional and primarily concerned with finding the most appropriate program to cope with the personal and educational development of early adolescents. According to Davis (1972) the middle school, or intermediate school, is designed for a meaningful education for children between ages 10 and 14.

Educators have been motivated by three forces to redefine the functions of the middle school (Eickhorn, 1973). They are: 1) the growing knowledge of characteristics of early adolescents, 2) changes in culture (population shifts, mobility, racial equality, transportation and community development, development of technology), and 3) existing middle schools have become rigid and institutionalized.

According to most advocates of the intermediate school organization, such a structure will facilitate the implementation of educational programs that are relevant to emerging adolescence, i.e., that give each child opportunities for increasing self-identity, for comprehension of his environment, and for attaining his or her full potential in understandings and skills.

The two functions of schools for adolescents that McCandless and Evans (1973) are agreed upon are: 1) skills training-cultural transmission, and 2) the actualization function.

Modal Behaviour 31

> The adolescent turns to the school for help in fulfilling certain fundamental needs in life. The school is uniquely suited to help adolescents develop a realistic comprehension of the world around them, increase their abilities to think and communicate effectively, and assume responsibility for their lives. Further, it should stimulate a desire to continue learning, essential to the attainment of full self-actualization. The particular expression of such needs and emphases may change from generation to generation and when they do the school must be prepared to change also (Conger, 1973; McCandless, 1970; Adams, 1968; Jersild, 1963).

Variances

Sex

In the opinion of some, parents should give their children as much instruction as possible in all aspects of sex education; however, Adams (1968) and Staton (1963) feel that in a modern concept of schools there should be a place for the school to assume responsibility with particular emphasis on giving the adolescent an understanding and appreciation of the anatomy, physiology, chemistry, and biology and psychology of sex.

Most adolescents desire greater openness and honesty about sex (Harris, 1971; Simon and Gagnon, 1970; Yankelovich, 1969). Ninety-eight per cent of a large sample of middle-class adolescent girls, ages 13 to 19, wanted broadly inclusive sex education in school. They not only were concerned about biological information and sex techniques but they wanted even more information about the meaning of sex in and out of marriage and the relationship between sex and love (Hunt, 1970).

Administering the General Aptitude Test for over 35,000 high school students, Droege (1966) found that girls did better on tests relying on verbal skills, whereas boys excelled on performance tests. Consistently, girls get better grades than boys throughout the school years, even in subjects in which boys score higher on achievement tests (Maccoby, 1966).

Socio-Economic

McCandless (1970) contends that the adolescent period is one in which compensation for intellectual, emotional, and behavioural retardation can be provided for between 70 and 85 per cent of cases who receive a massive compensatory training program between about 13 and 16 years of age.

Leidy and Starry (1967) in comparing the findings of a nationwide survey of adolescents conducted by the Purdue Opinion Panel found that most students favour a student government with some say as to school operation, but they do not support the idea of student government having discipline power over the students.

No direct studies dealing with age variance were found in this search of the literature for this modal behaviour.

Other Important Factors and Conditions

According to the findings of Task Force III of the Joint Commission on Mental Health of Children (1973) one role of the school has changed from a peripheral position to a central one for today's youth in that it has become a major bridge for the adolescent into a place in society. Twenty years ago there were other avenues to employability for the child who failed in school. The Commission concluded that, today, education seems to be the only road to preparation for work. In order for each youth to be able to read, write, handle numbers, and know his culture well, it seems advisable for all youth to remain in school until age 16 or older (McCandless and Evans, 1973).

The adolescent needs guidance and help at school. A good school recognizes an adolescent's need for independence and his striving for emancipation. By careful planning, it will allow the adolescent opportunities and means to work toward an independent status, encouraging him to assume responsibilities, make decisions and plan for the future (Horrocks, 1969).

Schools need to provide an atmosphere that makes learning a rewarding and relevant experience, one that promotes self-confidence, self-respect and a sense of cultural identity--particularly in the case of minority students (Mussen, Conger, and Kagan, 1974).

One of the major obligations of the school is to facilitate the adolescent's social and psychological growth (Forslund and Hull, 1972; Gordon, 1972).

Davis (1972) found that many educators and psychologists believe that today's youth have different needs from the children of the past. Children are reaching adolescence at an earlier age because of earlier social, physical and emotional maturity. (The latter seems to be a moot question (see Helding and Myers, 1970)). The adolescent should be better off from a psychological and social point of view when he goes out on his own (McCandless, 1970).

Another task of the school is to help the child toward happiness, self-acceptance, realistic self-esteem and pride in himself (McCandless, 1970).

Adolescents, according to a Report of Poll No. 93 of the Purdue Opinion Panel (January, 1972) felt that they were working at satisfactory levels in reading comprehension, reading speed, writing, speaking, physical, mathematical, mechanical, problem solving, social, vocational employment, and home-family management (Erlick, 1972):

1. Knowing how to get along with other people --36 per cent polled.

2. Sense of discipline and responsibility
   --33 per cent polled.

3. Vocational skill
   --14 per cent polled.

4. Skill in basic subjects
   --14 per cent polled.

5. Knowledge about our society
   --3 per cent polled.

Modal Behaviour 32

There are a number of situational factors in the school environment which have an effect on the quality of the social and psychological development of the adolescent and his educational attainment. Principal among them are teachers, peers, influence of parents, size and organization of the school (Mussen, Conger and Kagan, 1974; Tec, 1973; Erlick, 1973; Bachman, 1972; Horrocks, 1969).

Variances

Age

McCandless and Evans (1973) believe that professional guidance services should be available to adolescents at an early age. Hollander (1971) found that vocational decisions by the majority of youth were rather firm by the twelfth grade.

Sex

There are wide variations in the effects of cliques on students differing in ability and sex (Anderson, 1970). Cliques seem to aid low-ability females while the below-average ability males use cliques to escape their responsibilities to school and substitute them for peer group non-learning norms. Classroom intimacy is positively related for high-ability girls and has a negative effect on learning for girls with low ability (Anderson, 1970).

In a study of high school experiences relating to the creative personality, Halpin et al.(1973), found experiences differ for males and females.

Socio-Economic

Socio-economic status of a child's family is significantly related to his level of educational aspiration and to school achievement. Children of high socio-economic status aspire to higher educational levels than lower-middle and lower-class peers (Mussen, Conger, and Kagan, 1974; Bachman, 1972; Berman and Eisenberg, 1971; The American Almanac, 1971; Bachman, 1970).

Hollingshead (1949) observed that children of different social classes remain apart in school affairs.

According to Horrocks (1969) North American schools tend to have the middle-class as their focus. The lower-class child tends to be handicapped by this trend.

Nechama Tec (1973) in a social survey of 1,704 teen-age boys and girls conducted in a well-to-do surburban community on parental educational pressure and its effects on conformity concluded that the stronger the parental pressure, the less the likelihood of educational conformity. The evidence varied in one indicator, that of acceptance of the school as a vehicle for advancement and the presence and level of educational aspirations.

Other Important Factors and Conditions

In order to facilitate education and good mental health for all youth, Tannenbaum (1973) proposed two changes:

1. Spread education into the community for pre-school-age, school-age, and post-school-age youth.
2. Stratify instructional staffs to include assisting adults and adolescents.

According to Mussen, Conger, and Kagan (1974), the adolescent's career choice will be affected by his school environment, his teachers, and the peers with whom he associates.

Morse and Wingo (1969) find that teachers may become a figure for identification and imitation with which the adolescent can discuss problems. A survey of adolescents' opinions using the Purdue Opinion Panel Poll No. 95 (1972), revealed that thirty-six per cent of students polled thought teachers treated them as responsible individuals; thirty-six per cent thought "most" teachers were willing to listen to their opinions; thirty-four per cent felt "most" teachers encouraged students to do their best; twenty-seven per cent felt "some" teachers offered to help develop effective study and work habits; thirty-two per cent of the students felt "some" teachers really understand students their age; and forty-two per cent found it "sometimes" easy to talk with their teachers (Erlick et al., 1973).

Evidence that students in small high schools score lower on achievement tests was observed by Flanagan (1962), Wattenberg (1973), and Bledsoe (1959).

In one of a series of research studies in which they measured classroom climate and individual learning, Walberg and Anderson (1968) found that groups of climate variables predicted learning better than others. Among these were isomorphism (the tendency for class members to be treated equally), organization (efficient direction of activity), and synergism (personal relations among class members).

Results of a study of effects of classroom social climate on individual learners conducted by Anderson (1970) suggest that characteristics of class groups have significant effects on learning and that there are wide differences in these effects for students differing in ability and sex.

Cusick (1973) speaks of the class as "series of dyads, triads, cliques, and groups". These groups provide the individual members with ways in which to participate, interact, and gain recognition (Cusick, 1973; McCandless, 1970). In the Report of Poll No. 93 of the Purdue Opinion Panel (1972), forty-eight per cent of the students polled said that classroom exercises were most important in learning school work. Cole and Hall (1970) discern that social environment in the classroom results in character development of adolescents.

Adolescents appear to be looking to faculty for guidance and direction. In the Report of Poll No. 88 of the Purdue Opinion Panel (1972), fourteen per cent of students polled reported the staff as rejecting, ten per cent reported the staff as supporting, seventy-six per cent reported the staff in between supporting-rejecting ends of a continuum, and fifty per cent saw teachers as friendly and sympathetic (Erlick, 1970).

In 1969 Offer stated that "adolescents believe that few teachers treat them as individuals". The Purdue Opinion Panel, Poll No. 88, Item 9 (1970), reported that forty-two per cent of students polled felt "most" teachers treat students as responsible individuals (Erlick, 1970).

Forslund and Hull (1972) report there is a need for male teachers to serve as role models for both boys and girls. High school students favour their teachers expressing their personal opinions and judgments about material being taught (Remmers and Radler, 1957).

Modal Behaviour 33

> The nature of the school and the nature of the adolescent both contribute to the creation of problems in the educative process during adolescence (Gordon, 1972; Erlick, 1970; Offer, 1969).

Other Important Factors and Conditions

A decade ago in 1962, Lichter, Rapien, Seibert, and Sklansky (1962) discovered that forty per cent of North American children drop out of school before high school graduation. They found the cause was lack of success because of severe emotional problems. Morse and Wingo (1969) saw the need for the schools to provide adequate programming for these potential drop-outs. Nearly a third of North American youth fail to finish high school (McCandless and Evans, 1973). According to the Purdue Opinion Panel, Poll No. 95, Item No. 19, (1972) sixty-one per cent of all students polled selected "never" to thinking about dropping out of school (Erlick, 1972). In the area of behaviour, forty-two per cent of adolescents worry "not very much" about "being tempted to cheat in school, sometimes lying without meaning to; lacking self-control; getting into trouble; deliberately hurting people's feelings; etc.". Several responses indicated the need for group counselling in areas of values (42%), behaviour (36%), getting along with parents (43%) (Erlick, 1972).

The school should identify and fill the needs of those children who are potential "drop-outs". It is suggested that eventual drop-outs in general are physically unattractive, poorly groomed, lack social know-how, are shy, withdrawn and unhappy. Many who drop out of school may be escaping from intolerable social situations (Kuhlen and Collister, 1952). In 1965, Mead deplored that "millions of present day adolescents condemned by social circumstances to learn very little at school and to live a life in which their potentialities are never realized" (Mead, 1965).

The greatest percentage of students, ages 10 to 19, report school as the biggest personal problem causing them difficulty (Adams, 1964). Counselling needs of students is high--seventy-six per cent of all students express a need for counselling. Counselling to accommodate informational need ranges from twenty per cent to thirty-seven per cent. Counselling for personal problems or growth, ranges from four per cent to talk about behaviour to twenty-one per cent to talk about self (Erlick, 1970).

Modal Behaviour 34

Adolescents express a variety of attitudes toward school (Erlick, 1972; Sprinthall and Mosher, 1970; Leidy and Starry, 1969; Remmers and Radler, 1956).

Variances

Socio-Economic

Sprinthall and Mosher (1970) in an investigation of perceptions, attitudes and motives toward schools in which they studied a random sample of 60 eleventh-graders from each of three schools of different socio-economic backgrounds, indicated that the major differences in attitudes, perceptions, motives, and decision-making styles were due to school differences. Urban school pupils viewed learning as a passive obedience to teacher directives. Suburban pupils exhibited the strongest extrinsic motivation toward studying, especially among boys. The suburban pupils tended to rely on directions from others but to a lesser extent that the urban pupils in the area of decision-making.

No direct studies dealing with age and sex variances were found in this search of the literature for this modal behaviour.

Other Important Factors and Conditions

School is a constant concern of North American youth. Between the years 1953-1967 in answer to the question of how they felt about school, two to three per cent consistently said that they disliked school while forty-three per cent in 1953, forty-six per cent in 1958, fifty-one per cent in 1965, and fifty-seven per cent in 1967 moderately claimed they liked it most of the time (Leidy and Starry, 1969). According to the Purdue Opinion Panel, Poll No. 95, a general conclusion was made that most high school students have positive attitudes about the value of education. Sixty-six per cent of students felt school is important because knowing a lot is important and sixty-two per cent felt it not only had practical value but that learning itself was worthwhile. Of the students polled, sixty-nine per cent would choose to stay in school even if a good job were offered (Erlick, 1972).

Remmers and Radler (1956) report that fifty-eight per cent of the total sample of high school students questioned agree that high school gives them the training they need. There was a slight deviation between rural and urban areas in that slightly more urban students than rural students agreed. Eighty per cent of the students feel that the courses in school are practical in preparing them for the future.

Mead (1965) observed that 13-year-olds feel that school is an endless and wearisome process and that young adolescents today are bored.

4. Summary for Emotional and Social Development

This chapter has presented a wide array of information on the normal expectations for emotional and social development of adolescents. Thirty-four modal behaviours have been identified and documented with evidence of the behaviour's existence in the middle-class culture with important variations for age, sex, or cultural differences accounted for. The normal expectations, so identified, reveal the following characteristic behaviour in the emotional and social development respectively:

1. Emotional maturity is expected to increase with age, but its pace is conditioned by a number of factors inherent in the individual himself and the cultural milieu.

2. As he matures the adolescent is increasingly aware that emotional maturity is more than the simple control of one's overt display of emotion.

3. Adolescents who deviate markedly from the norm in the timing and rate of sexual maturing are those most likely to experience heightened emotionality.

4. Causes of heightened emotionality in adolescence are multiple and will include, in addition to the rapid and marked physical changes accompanying the development of sexual maturity, such other factors as social change, physical health and nutrition.

5. The style of coping with crises in adolescents is not unlike that for other periods in life. Typically the average adolescent will meet crises in this period in a manner that will increase his emotional stability. Crises serve to stabilize rather than threaten personality development.

6. Anger outbursts are common during early adolescence but in general reduce with age and become more controllable.

7. The characteristic response to anger in early adolescence is to leave the scene.

8. The most frequent cause of anger for adolescents is found in social relationships.

9. In early adolescents, particularly ages 12 and 13, the verbal retort supplants physical violence as a common expression of anger.

10. The early adolescent's perception and interpretation of violent aggressive acts is related to differences in personal life patterns.

11. The type of fear will vary according to age, sex, and socioeconomic conditions. Individual differences within categories will occur as well, depending on what is important in the unique lifestyle of the individual.

12. The dominant fears of adolescents are related to social situations and represent a significant change from childhood fears.

13. A main source of anxiety and worry for adolescents at all ages, 12 to 16, is the school.

14. Anxiety is more likely to occur in an adolescent if the individual feels that he is unable to meet the cultural expectations for him.

15. The shock of puberty is a source of increased anxiety at the beginning of adolescence. It may be anticipated that the adolescent will spend much time in deep thought, usually secretive, about the changes both physical and emotional that are taking place at the moment. Normally, outbursts of anxiety will begin to subside in about two or three years as the adolescent becomes accustomed to the new aspects of self.

16. Marked changes in cognitive ability contribute to an increased potential for anxiety and worry in early adolescence. When the adolescent is capable of carrying out formal operations in his thinking, he is no longer confined to perceived realities and can formulate hypotheses which may serve to stimulate a vivid imagination.

17. On the whole, most adolescents in the age range 12 to 16 are happy and experience many joys.

18. Affection for others becomes more intense during adolescence. This affection is usually focused on peers, adults outside of the home and occasionally family pets. The adolescent is more tolerant and loyal to a person towards whom he is affectionate than for someone else; however, he will refrain from open display of affection (e.g., kissing) for fear of ridicule, social disapproval or rejection.

19. A major task of adolescence is the reevaluation and redefinition of the self-concept. The advent of puberty and the shift in society's attitude toward the individual force major changes in the concept of self; thus, the adolescent typically begins an assessment of himself from several perspectives, with particular emphasis on the real and the idealized self.

20. The individual during adolescence becomes especially observant of his intellectual competence, physical attractiveness, physical skills, social attractiveness, sex identification, leadership and moral qualities and sense of humour as they unfold.

21. Self-esteem plays a major role in the development of a positive self-concept in adolescence. It is a product of the value the individual places on the complex of views he has of himself--whether approving or disapproving; accepting or rejecting.

22. A new kind of egocentrism begins to unfold in adolescence. It is an egocentrism which is clearly distinguished from the egocentrism of earlier childhood largely in terms of the increased ability to conceptualize thought, both of self and others. As he becomes capable of formal operations and can consider hypothetical possibilities, the early adolescent characteristically believes that others are as preoccupied with his appearance and behaviour as he is.

Social Characteristics

23. Autonomy becomes a major developmental need during adolescence. Normally the move toward autonomy proceeds with minimal conflict and struggle within the family, but some antagonism is to be expected. Parents typically are understanding and supportive of the adolescents' needs to become independent and self-sufficient.

24. Although highly differentiated from earlier childhood dependence, there are still throughout adolescence many needs which must be fulfilled through appropriate interaction with the parents and the family if trauma or maladjustment is to be avoided.

25. Within the range of normal adolescent development, some problems and conflicts between the adolescent and his family will occur and will vary according to basic personal and cultural factors. In addition to autonomy, friction may develop over home conditions, lack of communications, conflicting values, and control and authority.

26. Studies have shown that there is an overlap in the values of parents and peer groups, and because of this the adolescent will often retain the moral and social values and beliefs of his parents.

27. A strong need to be part of a peer group develops early in adolescence. Stimulated largely by a lack of confidence and need for reassurance outside the home, it heightens the need to conform to peer group standards and becomes an important factor in the maintenance of emotional security, development of social attitudes and behaviour, and definition of identity.

28. The adolescent often becomes part of two basic peer groups formed on the basis of social and ethnic background, common interests and maturity: the clique and the crowd.

29. Dating helps the adolescent to develop social and interpersonal skills with the opposite sex as well as to develop a sense of identity and sexual awareness. Likewise, interest in the opposite sex increases with maturity and changes from a purely social need for interaction to one of enjoying being with a certain individual.

30. Friendships become very intense during adolescence. The number of friendships becomes a direct measure of the adolescent's popularity, acceptance and approval by his peers. Adolescents choose friends who share in personal and social characteristics and interests.

31. The adolescent turns to the school for help in fulfilling certain fundamental needs in life but all too frequently is disappointed.

32. There are a number of situational factors in the school environment which have an effect on the quality of the social and psychological development of the adolescent and his educational attainment. Principal among them are teachers, peers, influence of parents, size and organization of the school.

33. The nature of the school and the nature of the adolescent both contribute to the creation of problems in the educative process during adolescence.

34. Adolescents express a variety of attitudes toward school.

In addition to the delineation of the above characteristics, the organizational schema used in this chapter quickly identifies behaviours for which empirical evidence is meagre or conflicting, and for which additional research is needed. Research attention on the following aspects of the modal behaviours cited in the body of this section of the report seems imperative in the light of major developmental tasks of adolescence:

1. Causes of heightened emotionality other than physical change and careful study of differences for sex and socio-economic conditions.
2. Coping style of adolescents in meeting crises, with a specific attempt to ascertain if there are significant differences in age, sex, and socio-economic conditions.
3. The basic sources or origins of the adolescent's inordinate fear and disdain, or even dislike of school.
4. The differential effect of changes in cognitive ability on the anxieties, worries and fantasies among boys and girls respectively.
5. Replication of studies on socio-economic differences in self-esteem are urgently needed to resolve the apparent conflicts in findings.
6. Sex differences in the egocentrism that unfolds in adolescence.
7. The socio-economic differences in the dynamics of cliques, crowds.
8. The school drop-out rate as it pertains to factors within the schools that are out of harmony with the growth needs and nature of the adolescent.

Careful study of the empirical evidence accrued on adolescent emotional and social development reveals the following educational implications. If wholesome development is to occur, adolescents will need particular help in:

1. Understanding the nature of the biological changes taking place in them and its significance.
2. Coping with a tendency toward moody and unpredictable behaviour as a consequence of the biological changes and confusion as to their status: whether that of a child or an adult.

3. Building up their self-confidence as a basic step in overcoming their tendency toward frequent outbursts of anger, boisterous behaviour and intolerant and opinionated attitudes.

4. Using their natural urge to become independent as an opportunity for participation in the building and perpetuation of a self-renewing society.

The school can contribute materially to the increased self-esteem of adolescents by giving them opportunities to be of service--to fulfill a service motive which can be a natural outlet for their new-found idealism. The curriculum should be studied with frequent reminders of the heroes of a modern democratic society and with opportunities to engage in real study and analysis of social problems. Emphasis on the latter should be on positive solutions and actions within their control on social issues such as population expansion, urbanization, economic growth, human adjustment to automation, air and water pollution, etc. The development of the rational capacity, vital to the survival of man, must become a high priority in the developmental history of the adolescent.

Adolescents urgently need adult leadership that has faith in the future and an unalterable confidence in the values of democratic processes. Teachers must be selected on the basis of their potential for the kind of interaction adolescents need with adults. Such teachers themselves must possess the inner resources that will produce a secure self-concept in their role as a teachers. Moreover, they should be sufficiently other-oriented to express genuine empathy for people of wide cultural ethnic and racial background and a particular zeal for working with adolescents.

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